SONY®

RECORDER UNIT
DNV-5

BETACAM SX

MAINTENANCE MANUAL Part 1
1st Edition (Revised 1)
Serial No. 10001 and Higher

⚠警告

このマニュアルは，サービス専用です。

お客様が，このマニュアルに記載された設置や保守，点検，修理など行うと感電や火災，人身事故につながることがあります。

危険をさけるため，サービストレーニングを受けた技術者のみご使用ください。

⚠WARNING

This manual is intended for qualified service personnel only.

To reduce the risk of electric shock, fire or injury, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

⚠WARNUNG

Die Anleitung ist nur für qualifiziertes Fachpersonal bestimmt.

Alle Wartungsarbeiten dürfen nur von qualifiziertem Fachpersonal ausgeführt werden. Um die Gefahr eines elektrischen Schlages, Feuergefahr und Verletzungen zu vermeiden, sind bei Wartungsarbeiten strikt die Angaben in der Anleitung zu befolgen. Andere als die angegeben Wartungsarbeiten dürfen nur von Personen ausgeführt werden, die eine spezielle Befähigung dazu besitzen.

⚠ AVERTISSEMENT

Ce manual est destiné uniquement aux personnes compétentes en charge de l'entretien. Afin de réduire les risques de décharge électrique, d'incendie ou de blessure n'effectuer que les réparations indiquées dans le mode d'emploi à moins d'être qualifié pour en effectuer d'autres. Pour toute réparation faire appel à une personne compétente uniquement.

Voor de klanten in Nederland

Dit apparaat bevat een MnO_2-Li batterij voor memory back-up.

Raadpleeg uw leverancier over de verwijdering van de batterij op het moment dat u het apparaat bij einde levensduur afdankt.

Gooi de batterij niet weg. maar lever hem in als KCA.
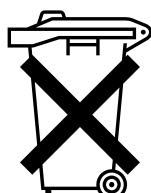
Bij dit produkt zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.

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Manual Structure

1. Service Overview

2. Error Code

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4. Block Diagram and Outline of Circuit

5. Periodic Maintenance and Inspection

Manual Structure

Purpose of this manual

This manual is maintenance manual of Recorder Unit DNV-5.

This manual describes the maintenance information of this unit, and the information on primary services such as the error message and cleaning procedures.

Contents

The following is a summary of the sections for understanding the contents of this manual.

Section 1   Service Overview

Explains the locations of main part, the functions of printed circuit board, the removal and installation of cabinet, and the measures against trouble.

Section 2   Error Code

Explains the error messages.

Section 3   Maintenance Mode

Explains the maintenance mode of this unit.

Section 4   Overall Block Diagrams and Circuit Descriptions

Describes the overall block diagrams and the circuit descriptions.

Section 5   Periodic Maintenance and Inspection

Explains the cleaning procedures and periodic checks.

Relative manual

Besides this "Maintenance Manual Part 1", the following manuals are available for this unit.

- **Operation Manual (Supplied with this unit.)**

  This manual is necessary for application and operation of this unit.

- **Maintenance Manual Part 2 (Not supplied with this unit.)**

  This manual describes the information items (adjustments, board layouts, schematic diagrams, detailed parts list, etc.) that premise the service based on parts. If this manual is required, please contact to Sony's service organization.

Section 1
Service Overview

1-1.   Operating Conditions

Operating temperature : 0 to 40 ˚C
Humidity   : 25 to 85 % (Relative humidity)
Storage temperature   : −20 to 60 ˚C

Use under special environment (Measure for cold area)
The unit is guaranteed its operation under the temperature of 0 to 40 ˚C. When the unit is used under 0 ˚C, cover-cloth against the cold is recommended to use.

1-2.   Supplied Accessories

Description	Part No.	Quantity
Shoulder belt	A-6772-374-A	1
BNC cap	3-604-795-01	5
Dust cap	3-676-269-00	1
XLR cap (2)	3-741-726-01	2
XLR cap (1)	3-741-727-01	2
Operation manual	–	1
Maintenance manual Part 1	–	1

1-3. Location of Main Parts and Function of Printed Circuit Boards

1-3-1. Location and Function of Printed Circuit Boards
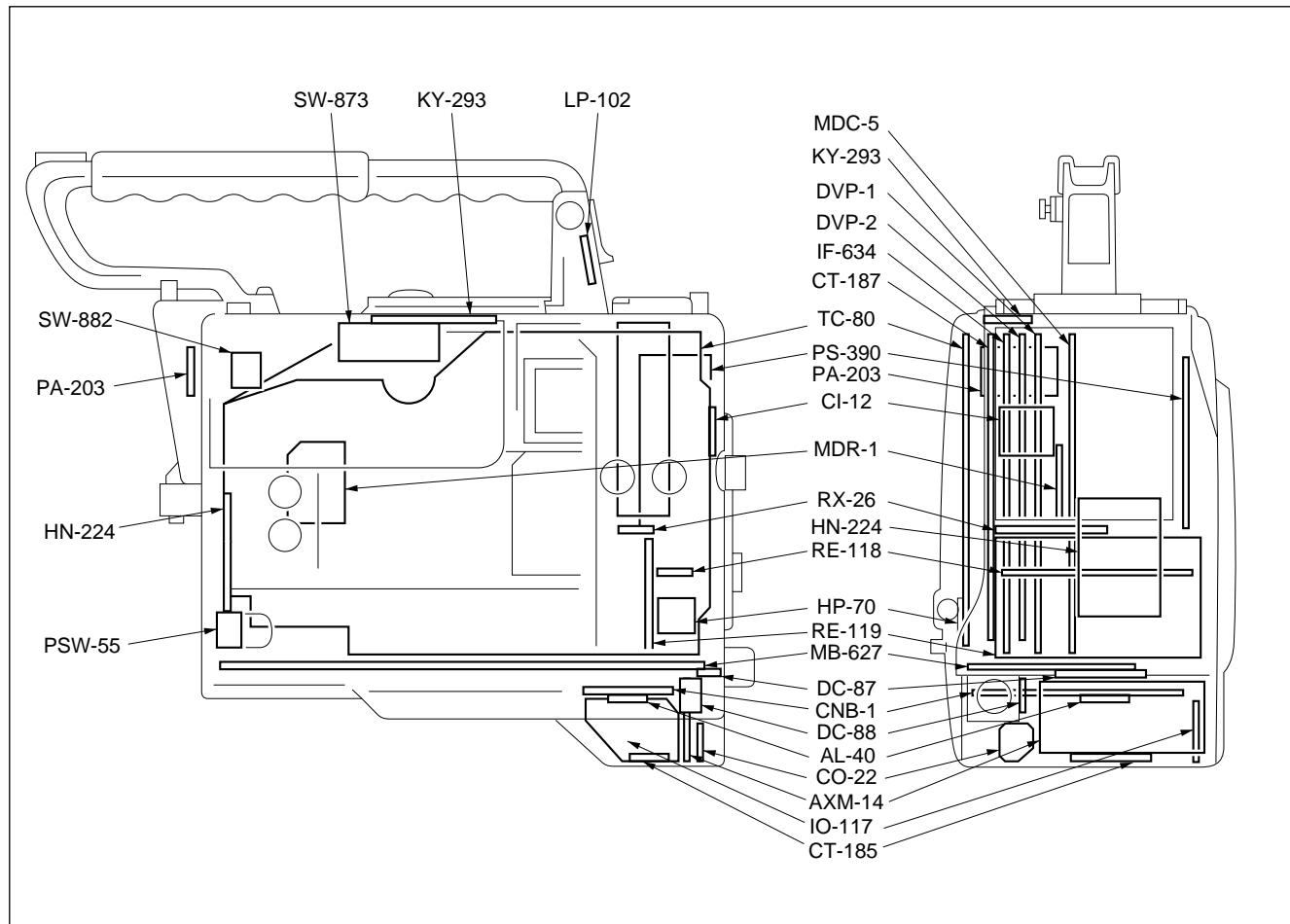
| System Configuration	Board Name	Circuit Function
VIDEO/AUDIO	CT-187	Camera Adaptor Control, 6P-remote Control, Setting Menu
	DVP-1	RF, Digital Audio Processor, Timing Clock Generator, System Controller for VTR Block
	DVP-2	Digital Bit Reduction Decoder, Digital Encoder, Digital Decoder
	IF-634	50-pin Interface, Video Input/Output
	PA-203	Audio Pre-amp for 50-pin
	TC-80	Analog Audio Processor, Time Code Generator
DRUM/SERVO	HN-224	Harness, TC Amp
	MDC-5	Servo Controller
	MDR-1	Drum Motor Driver
POWER SUPPLY	DC-87	Battery DC Filter
	PS-390	Power Supply (Light)
	RE-118	Regulator, Switching Control
	RE-119	Regulator
CONNECTOR BOX	AL-40	Audio CH-2 Line Out Amp
	AXM-14	Connector (AUDIO IN/OUT), Audio Pre-amp
	CNB-1	Circuit Breaker, Audio CH-1 Line Out Amp
	CO-22	Connector (VBS OUT)
	CT-185	Power Supply for 50-pin
	DC-88	External DC Filter
	IO-117	Connector (GEN LOCK IN, TEST OUT, TC IN, TC OUT)
OTHERS	CI-12	40-pin Adaptor Interface
	HP-70	Earphone
	KY-293	Function Key
	LP-102	Back Tally, Back Tally Switch
	PSW-55	Power Switch
	RX-26	Audio Pre-amp for Wireless Microphone
	SW-873	Menu and Light Auto/Manual Switch
	SW-882	Rotary Encoder Switch
	MB-627	Mother Board

1-3-2. Location of Main Mechanical Parts
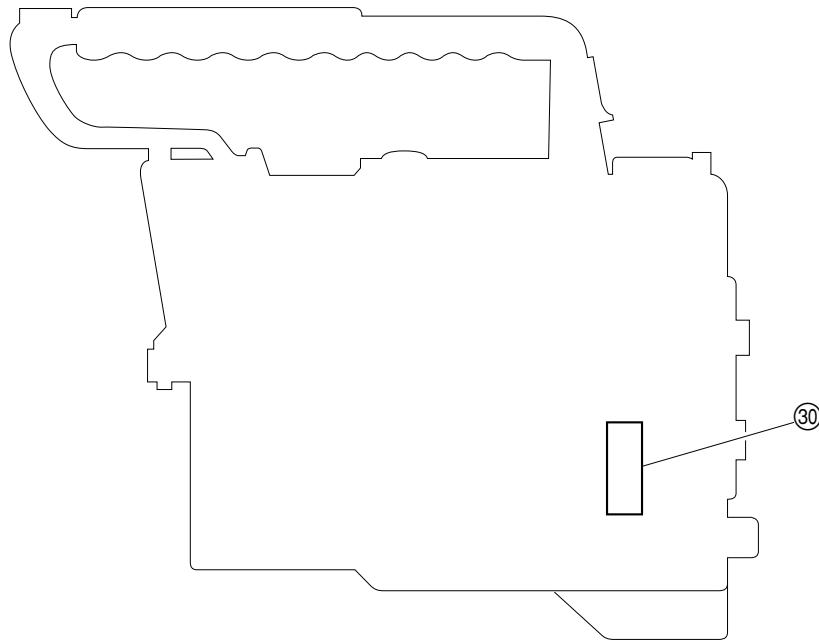
Mechanical deck
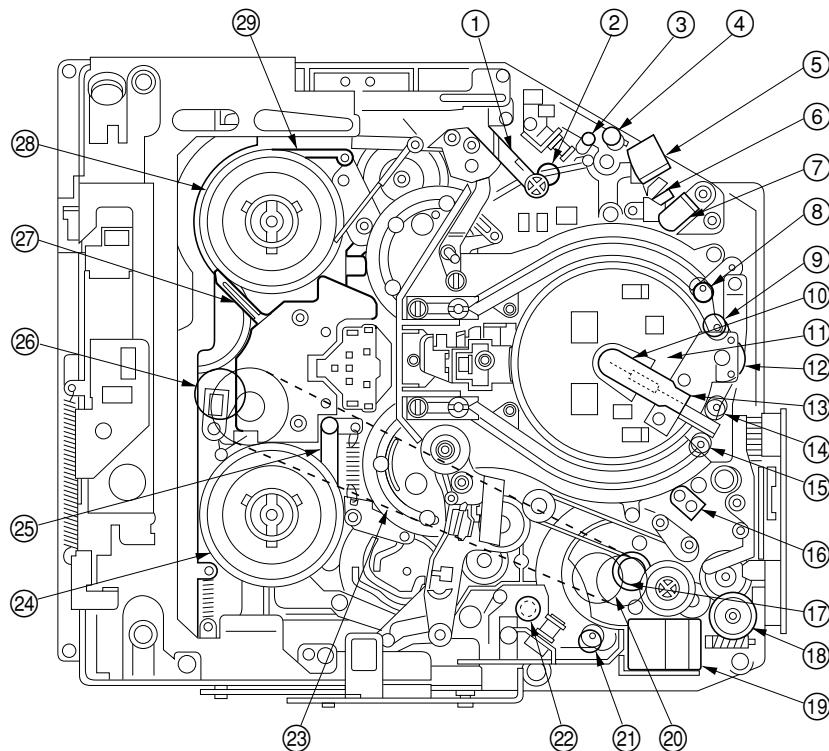
① : Tension regulator arm
② : S5 tape guide
③ : Tension regulator guide (S4 tape guide)
④ : S3 tape guide
⑤ : Full erase head
⑥ : Tape cleaner
⑦ : CTL head
⑧ : S2 tape guide (on S slider)
⑨ : S1 tape guide (on S slider)
⑩ : Slip ring
⑪ : Drum
⑫ : Video head cleaner
⑬ : Brush
⑭ : T1 tape guide (on T slider)
⑮ : T2 tape guide (on T slider)
⑯ : TC head
⑰ : Capstan motor
⑱ : Manual eject knob
⑲ : Threading motor
⑳ : Pinch roller
㉑ : T3 tape guide
㉒ : T4 tape guide
㉓ : Timing belt
㉔ : T reel table
㉕ : T soft brake
㉖ : Gear
㉗ : S soft brake
㉘ : S reel table
㉙ : Tension regulater band
㉚ : Fan motor

1-3-3. Location and Function of Sensors

Mechanical deck
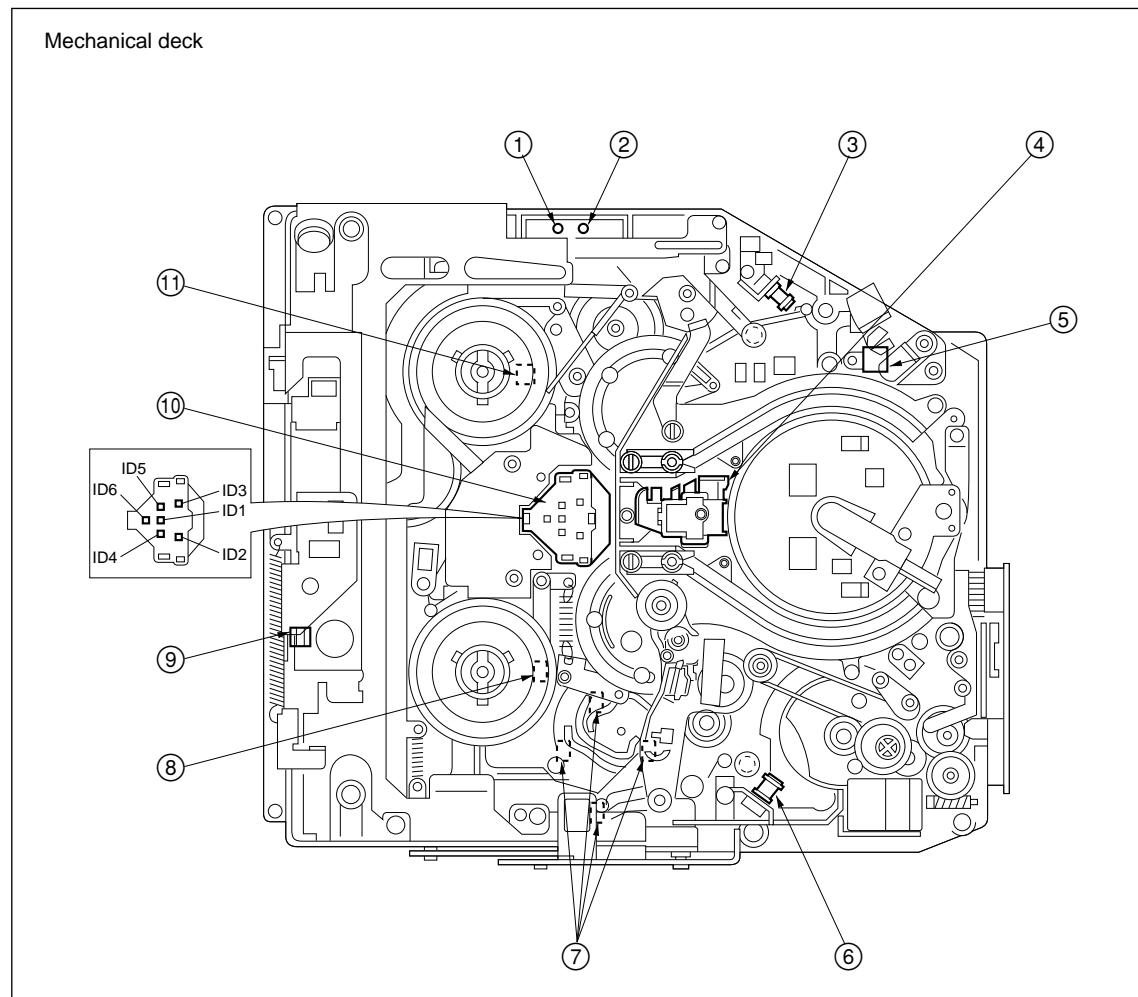
① : Cassette-in sensor

This sensor detects the existence of a cassette.

② : REC inhibit sensor

This sensor detects the REC inhibiting plug of the cassette tape.

③ : Tape end sensor

This sensor detects the end of the tape that runs in the forward direction.

④ : Full top sensor

This sensor detects whether the cassette tape is the full top.

⑤ : Condensation sensor

This sensor detects whether the dew condensation occurs in the unit.

⑥ : Tape top sensor

This sensor detects the end of the tape that runs in the reverse direction.

⑦ : Function cam sensor

This sensor detects the rotation position of a cam.

⑧ : Take-up reel table rotating sensor

This sensor detects the rotation of the take-up reel table. The FG output signal of this sensor is input to a servo circuit so as to calculate the winding diameter of the tape.

⑨ : Cassette lock sensor (switch)

This sensor detects that the cassette compartment was locked.

⑩ : Cassette ID sensors

ID1 : Tape type sensor

This sensor detects the tape type either an oxide or a metal.

ID2 : Tape thickness sensor

Using a tub on the back side of the cassette tape, this sensor detects the thickness of the tape wound on a cassette tape that is being inserted into the unit.

ID3 : Reel hub diameter sensor

The reel hub diameter of a cassette tape varies depending on the length of the tape wound on the cassette tape. The reel hub diameter sensor detects the reel hub diameter by the tab on the back side of the cassette tape.

ID4 to ID6 : Tape format sensors

These sensors detect the type of the cassette tape (for Betacam SX, Betacam SP and so on).

⑪ : Supply reel table rotating sensor

This sensor detects the rotation of the supply reel table. The FG output signal of this sensor is input to a servo circuit so as to calculate the winding diameter of the tape.

1-4.　Matching Connectors

When external cables are connected to the connector during maintenance, the hardware listed below (or the equivalents) must be used.

Panel Indication	Matching Cable Connector/Cable	
	Name of Connector/Cable	Part No.
AUDIO IN CH-1/CH-2	XLR 3-pin, male XLR 3-pin, female	1-508-084-00 (for SY) 1-508-083-00 (for J)
AUDIO OUT	Audio cable (XLR 5-pin − XLR 3-pin , 2m)	SONY CCXA-53 or equivalent
GENLOCK IN TC IN TC OUT TEST OUT VBS OUT	BNC	1-560-069-11
DC IN	XLR 4-pin, female	1-508-362-00
DC OUT 12 V	DIN 4-pin, male	1-566-425-11
REMOTE	6-pin, male	1-560-078-00
CAMERA	50-pin, male	1-562-112-21
EARPHONE	Mini jack	Standard product
LIGHT	Power tap [OE]	ANTONBAUER 33710 or equivalent

1-5. Signal Input and Output

INPUT

VIDEO	1.0 V p-p, 1 kΩ
GENLOCK IN	1.0 V p-p, 75 Ω
TC IN	0.5 V to 18 V p-p, 10 kΩ
AUDIO IN CH-1/CH-2	−60 dBu/+4 dBu
	(0 dBu = 0.775 V rms)

OUTPUT

TEST OUT	1.0 V p-p, 75 Ω, unbalanced
TC OUT	1.0 V p-p, 75 Ω
VIDEO OUT	1.0 V p-p, 75 Ω, unbalanced
EARPHONE	−∞ to −18 dBu, adjustable, 8 Ω
AUDIO OUT	0 dBm (600 Ω terminated)

DC IN:XLR 4-pin, male

\<External View\>
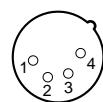
Pin No.	Signal
1	GND
2	−
3	−
4	EXT DC (DC 11 to 17 V)

DC OUT 12V:DIN 4-pin, female

\<External View\>

Pin No.	Signal
1	UNREG GND
2	−
3	−
4	UNREG +12 V (DC 11 to 17 V, 0.1 A MAX)

BATT IN:5-pin, male

\<External View\>
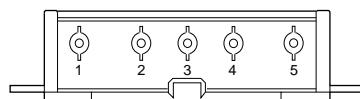
Pin No.	Signal
1	BATT IN (−)
2	BATT ID
3	BATT REM
4	LIGHT CONT
5	BATT IN (+)

REMOTE:6-pin, female

\<External View\>
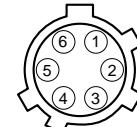
Pin No.	Signal
1	SD (RM)
2	SD (RM) I/O
3	UNREG GND
4	RM TEST (X)
5	RM TEST (G)
6	UNREG +12 V

LIGHT:2-pin, female

<External View>
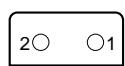
Pin No.	Signal
1	LIGHT +12 V (30 W MAX)
2	GND

AUDIO OUT:XLR 5-pin, male

<External View>
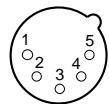
Pin No.	Signal
1	GND
2	CH1 (X)
3	CH1 (Y)
4	CH2 (X)
5	CH2 (Y)

CAMERA:50-pin, female

<External View>

Pin No.	I/O Signal	Specification		
		Camera/VA-5	Direction	VTR
1	GENLOCK VIDEO IN	$Z_i = 1$ kΩ ±5 %		VBS = 1 Vp-p ±3 dB (SYNC negative) Zo = Low Impedance
2	GENLOCK VIDEO(GND)			
3	∗+9 V OUT			
4	–			
5	GND (POWER)			
6	GND (POWER)			
7	–			
8	–			
9	–			
10	–			
11	–			
12	–			
13	–			
14	–			
15	MIC (GND)	-60 dBm (600 Ω)		$Z_i = 3$ to 10 kΩ
16	MIC (X)	Zo = Low Impedance		Balanced
17	MIC (Y)	(600 Ω or less) Balanced		
18	PB VIDEO	$Z_i = 1$ kΩ ±5 %		VS:1 Vp-p ±1 dB
19	GND			DC:0 ±200 mV Zo = 75 Ω ±5 %
20	∗AUDIO LEVEL INDICATE	$Z_i \geqq 1$ kΩ		Zo $\leqq30$ Ω -15 dBs±1 dB(Reference) CH-1 only
21	–			
22	TAPE IND.1 (10M)	Imax = 10 mA		H:4.5$\pm$ 0.5 V (Camera side open) L :$0^{+0.5}_{-0}$ V Zo = 330 Ω ±5 %
23	TAPE IND.2 (5M)	Imax = 10 mA		H :4.5 ±0.5 V (Camera side open) L :$0^{+0.5}_{-0}$ V Zo = 330 Ω ±5 %

Pin No.	I/O Signal	Specification		
		Camera/VA-5	Direction	VTR
24	REC TALLY	$Zi = 20$ kΩ	←	A/B: 50 ±10 % duty, frequency 1±0.2 Hz or 4 ±0.8 Hz
25	BATT IND	$Zi = 300$ Ω RED LED	←	14.5 V max open,2 to 3 V with 300 ohms load A/B: 50 + 10 % duty, frequency 1 ±0.2 Hz or 4 ±0.8 Hz ✳✳Before end : 11.5 V (Enables to set the voltage in the diagnostic menu.) 　　　End 　　: 11.0 V (Enables to set the voltage in the diagnostic menu.)
26	✳PB/CAM SWITCH CONTRO	$Zi = 100$ kΩ ±5 %	←	4.5 ±0.5 V $Zo = 10$ kΩ ±5 %, L:OPEN
27	VTR/START/ STOP	$Zo \leqq 10$ kΩ START: 5.0 ±1.0 V STOP: $0^{+0.2}_{-1.0}$ V	→	START: $5.0^{+0.3}_{-1.0}$ V STOP: $0^{+0.5}_{-1.0}$ V or OPEN
28	–			
29	R-Y VIDEO	V: 0.7 Vp-p ±2 % NTSC:75 % color bars PAL:100 % color bars		$Zi = 1$ kΩ ±5 %
30	R-Y (GND)	$Zo = 75$ Ω ±5 % DC: 0 ±200 mV		
31	✳CAMERA MIC LEVEL CONTROL	Control Voltage 7 V (MIN LEVEL) to 0 V (MAX LEVEL)	→	$Zi \geqq 100$ kΩ 0 V or OPEN: MAX LEVEL 7 V:MIN LEVEL
32	VTR SAVE	4.5 ±0.5 V (STAND BY : 0 V or OPEN) $Zo \leqq 10$ kΩ	→	$Zi \geqq 100$ kΩ (VTR should be in SAVE mode when camera is PREHEAT.)
33	AUDIO MONITOR	750 Ω/1 kHz	←	Low Impedance Level : −6 dBm
34	SYNC (⎍)	$V_{OH} = 5.0^{+0.2}_{-1.0}$ V $I_{OH} = 1$ mA max $V_{OH} = 0.8$ V max, $I_{OH} = -1.5$ mA max	→	(This signal should be in V_{OL} when SYNC OFF.)

Pin No.	I/O Signal	Specification		
		Camera/VA-5	Direction	VTR
35	–			
36	＊REW CONTROL	Z_i = 100 kΩ ±5 %	←	REW:4.5 ±0.5 V NORMAL: 0 ±0.5 V Z_o ≦10 kΩ
37	COLOR FRAMING (⎍)	5.0 ±1.0 V beginning V SYNC NTSC :1st Field (every 4 fields) V.SYNC/3H PULSE PAL :1st Field (every 8 fields) V .SYNC/2.5 H PULSE PAL M:1st Field (every 8 fields) V.SYNC/3H PULSE Z_o = 1 kΩ ±5 % DC OUT ≧ 10 µF	→	Z_i ≧ 100 kΩ
38	＊RETURN CONTROL	NORMAL：OPEN RETURN：0 V	←	Z_i ≧ 10Ω
39	+12 V (POWER)			10.6 V min(at 3A),17.0 V max
40	+12 V (POWER)			
41	LUMINANCE	VS : 1 Vp-p ±0.5 dB DC : 0 ±200 mV Z_o = 75 Ω ±5 % SET UP NTSC PAL-M:7.5 % 　　　 PAL 　　 : 0 %		
42	LUMINANCE (GND)	<table><tr><td></td><td>NTSC</td><td>PAL PAL-M SECAM</td></tr><tr><td>VIDEO</td><td>0.714 Vp-p</td><td>0.7 Vp-p</td></tr><tr><td>SYNC</td><td>0.286 Vp-p</td><td>0.3 Vp-p</td></tr></table>	→	Z_i = 75 Ω ±5 %
43	＊ENCODE VIDEO	VBS : 1 Vp-p ±1 dB Z_o = 75 Ω ±5 %	→	Z_i = 75 Ω ±5 %
44	＊GND	DC: 0 ±100 mV		
45	–			
46	–			
47	–			
48	–			
49	B-Y VIDEO	V : 0.7 Vp-p ±2 %	→	Z_i = 1 kΩ ±5 %
50	B-Y (GND)	Z_o = 75 Ω ±5 % DC: 0 ±200 mV NTSC:75 % color bars PAL :100 % color bars		
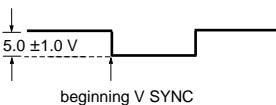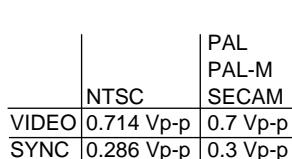
Note

＊marked signals are available only when a camera is connected.

1-6. Removal/Installation of Cabinet

Notes

· Be sure to turn off the power, then pull out the power cord and/or battery before performing the following procedure. If not, damage to internal circuit may result.

· The standard tightening torques of main screws used in this unit are as follows:

M1.4 (+) screw : 9×10^{-2} N·m (0.9 kgf·cm)

M2 (+), M3 (+) and hexagon screws : 19×10^{-2} N·m (1.9 kgf·cm)

Rib of the fromt lid

Front lid

Handle

Screws

Screws

Screws

Outside Panel

Hook section of the outside panel

CN30

Inside panel

Protection cover

Hinge

CN101

Shield plate

CN27

Hinge

Flexible card wires

CN102

CN701

Inside panel

Screws

Screws

Tighitening torque 80×10^{-2} N·m (8.1 kgf·cm)
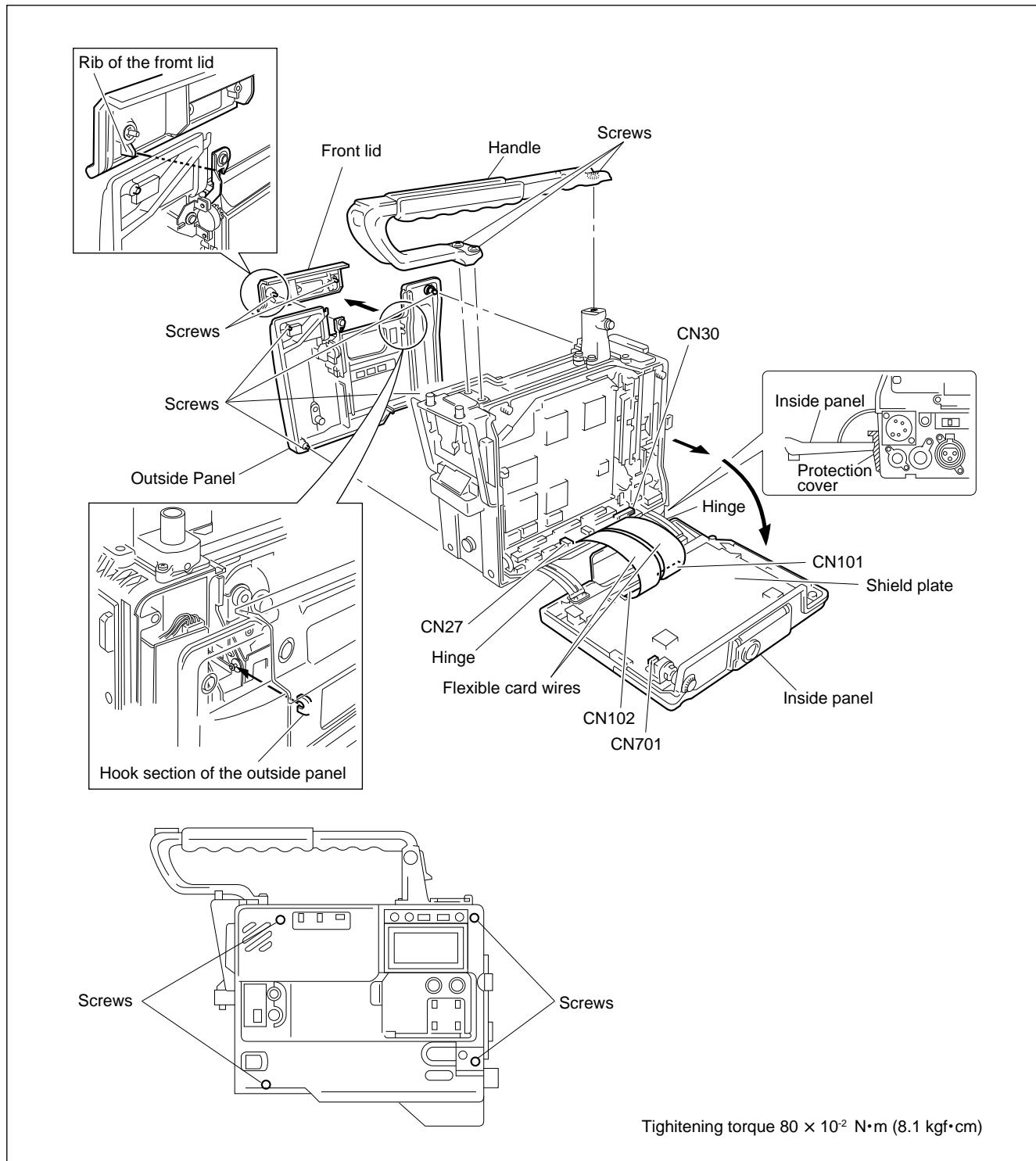
Handle

Loosen the three screws fully and remove the handle.
(Stoppers are provided for these screws.)

Front Lid

Loosen the two screws fully and remove the front lid.
(Stoppers are provided for these screws.)

| Note |

Insert the rib of the front lid firmly into the groove during installation.

Outside panel

1. Remove the front lid.
2. Loosen the four screws fully and remove the outside panel.
   (Stoppers are provided for these screws.)

| Note |

Insert the hook section of the outside panel firmly into the guide shaft of the cassette compartment during installation.

Inside Panel

1. Loosen the four screws fully and open the inside panel in the direction indicated by the arrow.
   (Stoppers are provided for these screws.)

| Notes |

· Be careful not to bend the two flexible wires intentionally.
· When opening, hook the inside panel on the protection cover of connector box to avoid damage to the cabinet.

2. Disconnect connectors CN27 and CN30 on the MB-627 board.
3. Remove the flexible card wires from connectors CN101 and CN102 on the TC-80 board.
   (Refer to section 1-15.)
4. Disconnect connector CN701 on the SW-882 board, remove the harness from the shield plate on the inside panel.
5. Remove the two hinges.

Connector Box

Removal

1. Remove the front lid, outside panel, and inside panel.
2. Loosen the four screws fully and remove the bottom cover.
   (Stoppers are provided for these screws.)
3. Remove the four screws, then remove the connector box.
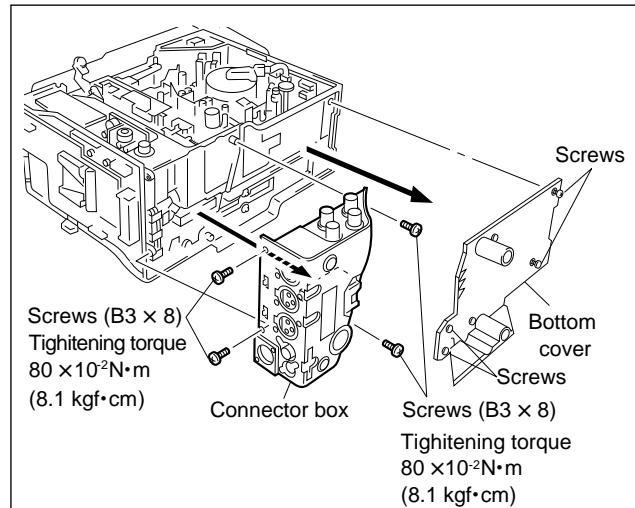
4. Disconnect connectors CN104 and CN105 on the CNB-1 board , and connecter CN1 on the CT-185 board.

Cautions during Installation

1. Connect the connector CN20 on the MB-627 board securely to the connector CN101 on the CNB-1 board in the connector box.
2. Connect the connectors CN104 and CN105 on the CNB-1 board, and connector CN1 on the CT-185 board and connecter CN1 on the CT-185 board, after attaching the connector box to the unit.
3. Be careful not to get caught the harness in the rib.

1-7. Removal/Installation of Cassette Compartment

Notes

· Be sure to turn off the power, then pull out the power cord and/or battery before performing the following procedure. If not, damage to internal circuit may result.
· The cassette compartment can be removed even if it comes up or goes down.

Removal

1. Remove the front lid and outside panel. (Refer to section 1-6.)
2. Remove the three screws, hold the position of the cassette compartment shown in the figure, and remove it in the direction indicated by the arrow.

(Omit the illustration of the frame)

Screws (M 1.4 × 3.5)

Screws (M 1.4 × 3.5)

Cassette compartment   Mechanical deck assembly
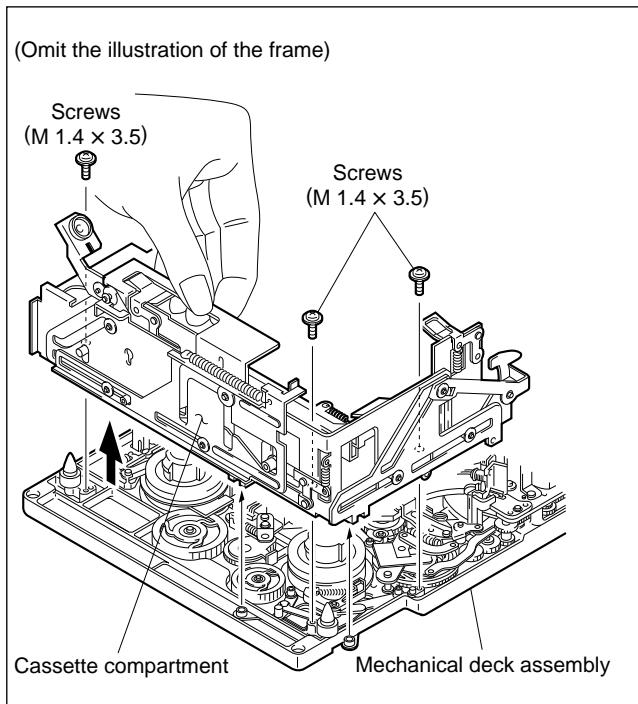
Installation

1. Adjust the position of the joint arm so that the clearance between the white roller's outer circumference of a joint arm and the end face of the mechanical deck assembly is 0.5 mm.

White roller

0.5 mm   Joint arm
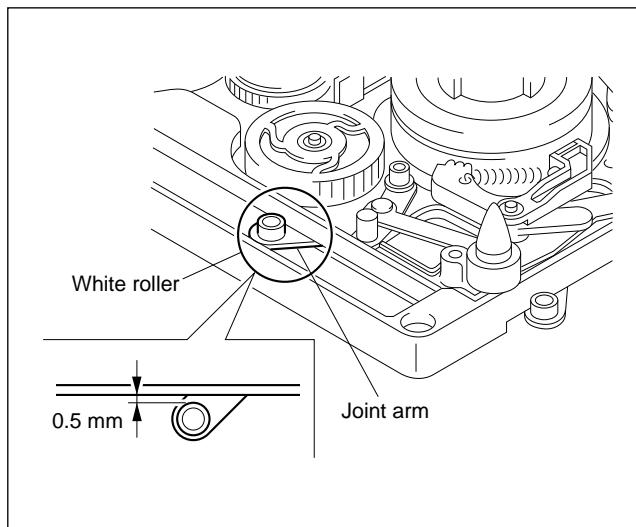
2. Raise the white lock roller of the cassette compartment so that it comes up.

White lock roller
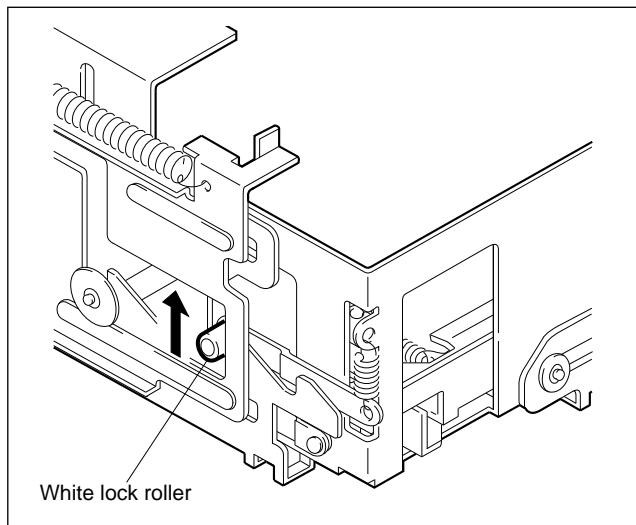
3. Move the cam plate (A) on the right side of the cassette compartment in the direction of the arrow with fingers as far as it will go.

Cam plate (A)
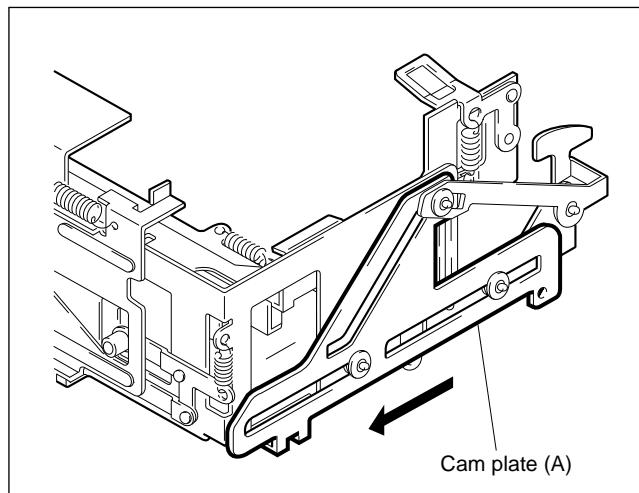
4. Hold the position of the cassette compartment shown in the figure and attach two cassette guide pins in the chassis so that they are put in the round holes of the stage.
   At that time, confirm that the other white roller of the joint arm positioned in step 1 is put in the notch of the cam plate (A) on the right side.
5. Push the lever of the cassette compartment and confirm that the stage smoothly moves up and down. If not, re-confirm steps 1 to 4.
6. Attach the cassette compartment with three screws.

Screws
(M 1.4 × 3.5)
Lever
Screws
(M 1.4 × 3.5)
Stage
Round hole
of the stage
Cassette guide pin
Notch
White roller
(step1)
Joint arm
Other
white roller
Notch of the
cam plate (A)
Cassette
guide pin

Tighitening torque 9 × 10^{-2} N·m (0.9 kgf·cm)
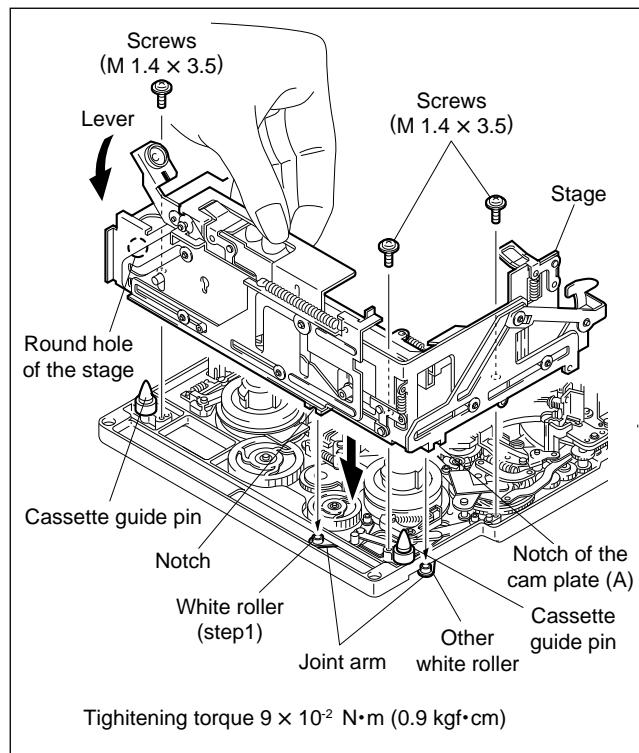
1-8. Pulling Out and Inserting the Plug-in Boards

Be careful attention so that the parts on the board are not damaged and the board is positioned and oriented correctly when pulling out and inserting the plug-in boards.
Replace each board after confirming the setting of switches and slit lands. (Refer to section 1-9.)
For the adjustment after board replacement, refer to "5. General Information for Electrical Alignment" of the Maintenance Manual Part 2 Vol-1.

Pulling out the plug-in board

1. Open the levers and disconnect the plug-in board from the connectors on the MB-627 board.
2. Pull out the plug-in board.

Levers
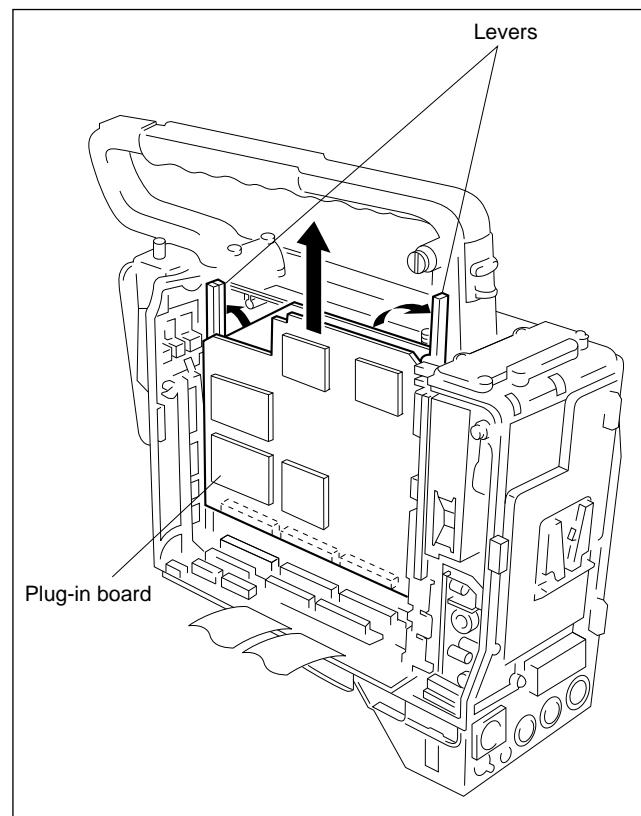
Plug-in board

Inserting the plug-in board

1. Insert the plug-in board along the board guide rails.
2. Connect the connector of the plug-in board to the connectors on the MB-627 board securely.
   Be sure to insert the plug-in board with levers in a horizonal position.

1-9. Switch/Slit Land Settings on the Boards

| Note |

For the factory-use switch and slit land, do not change the switch and slit land settings.

1-9-1. AXM-14 Board

AXM-14 B Side
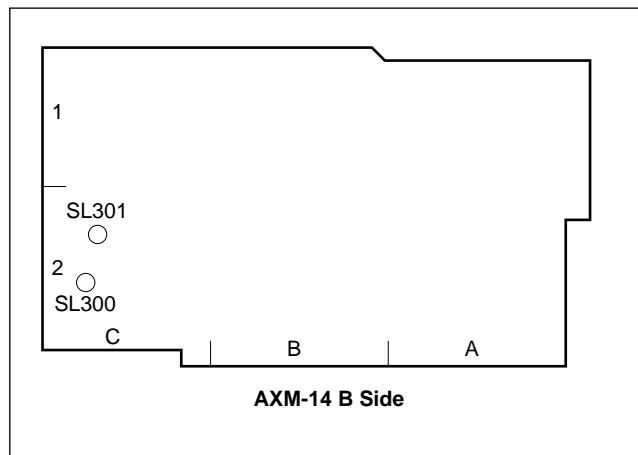
Slit Lands

Ref. No.	Name	Description	Factory setting
SL300	AUDIO OUT Select	OPEN : Outputs from the XLR 5-pin connector. SHORT : Outputs from the XLR 3-pin connector. [*2]	OPEN
SL301	AUDIO OUT Select	OPEN : Outputs from the XLR 3-pin connector. [*2] SHORT : Outputs from the XLR 5-pin connector.	SHORT [*1]

[*1] : This slit land is short-circuited by the traces on the board. Therefore, the traces must be cut using a knife when the setting is changed.

[*2] : The modification of the unit is necessary for change of connector.

1-9-2. CNB-1 Board

```
        1

   ○
  SL101

        2

        3

   ○
   SL1

        4

  A  |  B  |  C
```

CNB-1 A Side
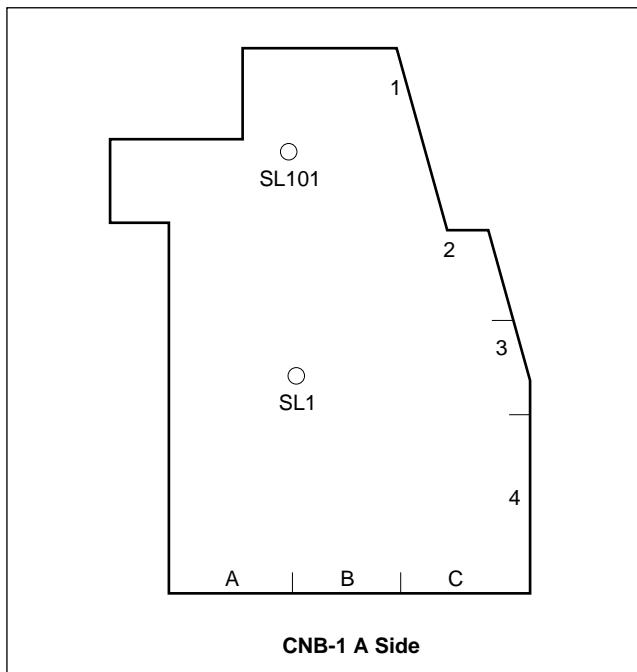
Slit Land

Ref. No.	Description	Factory setting
SL1 Destination select	OPEN : For except Japan SHORT : For Japan	OPEN (for except Japan) SHORT (for Japan)

Note

Set SL1 according to the destination during board replacement.

SL101 Power supply select
Slit short : Supplies electric power from the battery to the unit automatically when the external power supply voltage is lower than the battery voltage.
Slit open : Supplies electric power from the external power supply to the unit irrespective of the voltage level of the external power supply when the electric power is supplied from the external power supply.

Power supply select

Slit		Input voltage	Input voltage
		EXT DC > BATT	EXT DC < BATT
SL101	SHORT	EXT DC	BATT
	OPEN (Factory setting)	EXT DC	EXT DC

1-9-3. DVP-1 Board

DVP-1 A Side

DVP-1 B Side
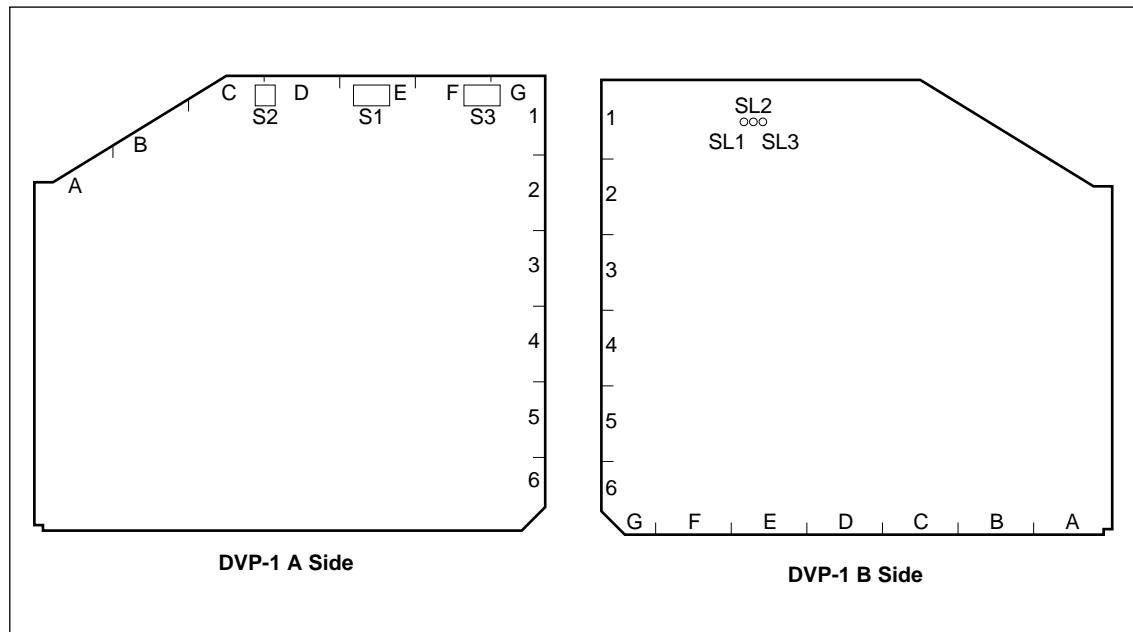
Switches

Ref. No	Name	Description	Factory setting
S1-1	Destination Select	OFF : NTSC ON : PAL	OFF (for NTSC) ON (for PAL)
S1-2	Model Select	ON : DNV-5 OFF : DNW-7/7P/90/90P/90WS/90WSP	ON
S1-2 to 8	–	Not used	OFF
S2-1 to 3	–	Factory use	OFF

S2-4	Model Select	OFF : DNV-5, DNW-7/7P
		
		ON : DNW-90/90P/90WS/90WSP
			OFF (for DNV-5,
			  DNW-7/7P)
			ON (for DNW-90/90P/
			  90WS/90WSP)

S3-1 to 8	–	Not used	OFF

Slit lands

Ref. No.	Description	Factory setting
SL1	Factory use	OPEN
SL2	Factory use	SHORT
SL3	Factory use	SHORT

1-9-4. DVP-2 Board

DVP-2 A Side
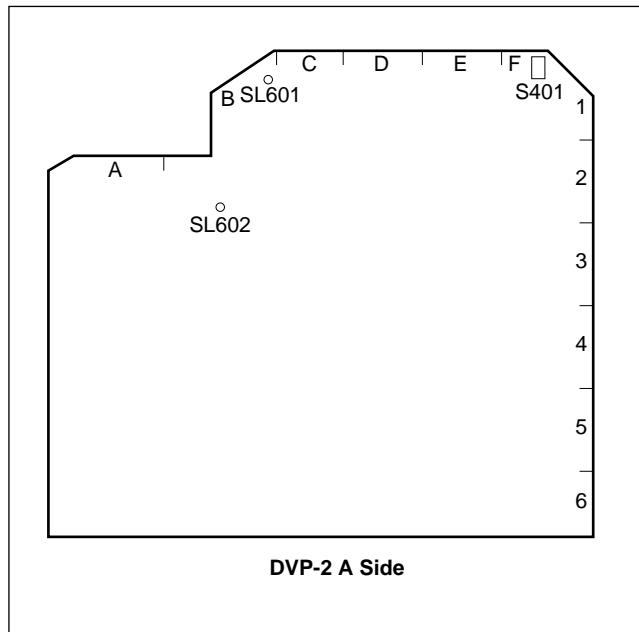
Switches

Ref. No.	Name	Description	Factory setting
S401-1	–	Factory use	OPEN
S401-2	–	Not used	OPEN

Slit Lands

Ref. No.	Description	Factory setting
SL601	Factory use	OPEN
SL602	Factory use	SHORT

1-9-5. TC-80 Board

TC-80 B Side
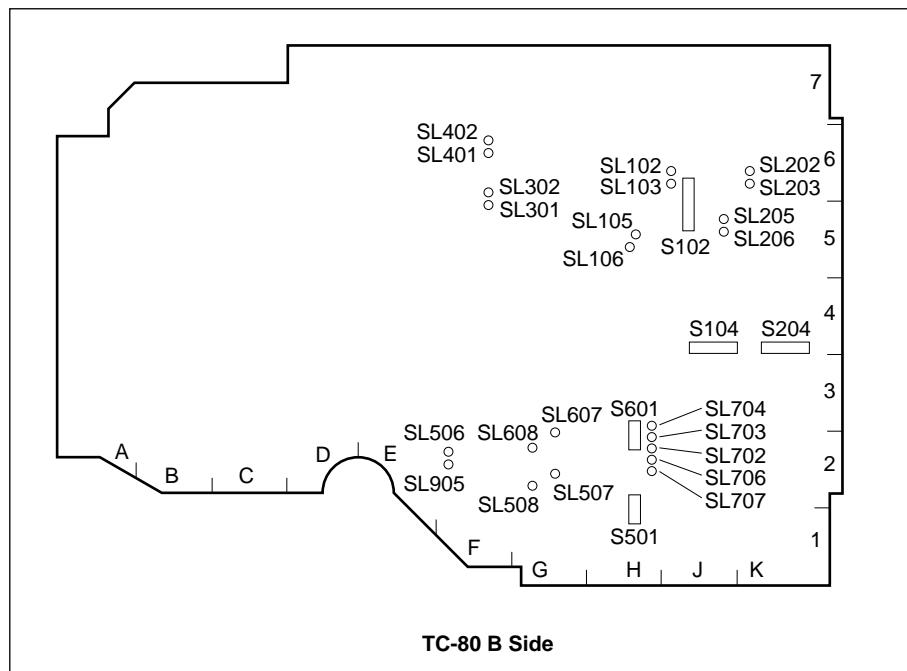
Switches

Ref. No.	Name	Description	Factory setting
S102	CH-1 Front MIC LEVEL Control	Selects whether to control CH-1 audio level of rear input by using the front MIC LEVEL control. ON : Enables OFF : Disables	OFF
S104	CH-1 Limiter	CH-1 Limiter OFF/ON	OFF
S204	CH-2 Limiter	CH-2 Limiter OFF/ON	OFF
S501	CH-1 Output Limiter	CH-1 Output Limiter OFF/ON(+10 dB limit)	ON
S601	CH-2 Output Limiter	CH-2 Output Limiter OFF/ON(+10 dB limit)	ON

Slit Lands

Headroom Level Select (Factory setting:20 dB)

Audio Channel	Ref. No.	Headroom (dB)		
		20	18	16
CH1 *1	SL102	OPEN	SHORT	OPEN
	SL103	OPEN	OPEN	SHORT
AGC CH1	SL105	OPEN	OPEN	SHORT
	SL106	OPEN	SHORT	OPEN
CH2 *1	SL202	OPEN	SHORT	OPEN
	SL203	OPEN	OPEN	SHORT
AGC CH2	SL205	OPEN	OPEN	SHORT
	SL206	OPEN	SHORT	OPEN
AGC CH3	SL301	OPEN	SHORT	OPEN
	SL302	OPEN	OPEN	SHORT
AGC CH4	SL401	OPEN	SHORT	OPEN
	SL402	OPEN	OPEN	SHORT

*1:This switch setting is enable to select when the AUDIO SELECT switch on the inside panel is selected MANU.

Ref. No.	Name	Description		Factory setting
SL506	CH1 Monitor Select	OPEN	: Selects the output signal of the CH-1 outputs connector using the MONITOR select switch on the inside panel. Set SL506 and SL905 are the same positions.	SHORT *1
		SHORT	: Outputs the CH-1 signal to the CH-1 output connector.	

*1:This slit land is short-circuited by the traces on the board. Therefore, the traces must be cut using a knife when the setting is changed.

Setting the Audio Output Level (Factory setting:0 dBm)

Audio Channel	Ref. No.	Output Level (dBm)		
		+4	0	
CH1	SL507	SHORT	OPEN	Set the same positions.
	SL508	SHORT	OPEN	
CH2	SL607	SHORT	OPEN	Set the same positions.
	SL608	SHORT	OPEN	

Ref. No	Name	Description		Factory setting
SL702	–	Factory use		SHORT
SL703	–	Factory use		SHORT
SL704	–	Factory use		SHORT
SL706	–	Factory use		SHORT
SL707	–	Factory use		SHORT
SL905	CH1 Monitor Select	OPEN	: Selects the output signal of the CH-1 output connector using the MONITOR select switch on the inside panel. Set SL506 and SL905 are the same positions.	SHORT *1
		SHORT	: Outputs the CH-1 signal to the CH-1 output connector.	

*1:This slit land is short-circuited by the traces on the board. Therefore, the traces must be cut using a knife when the setting is changed.

1-9-6. MDC-5 Board

MDC-5 A Side

MDC-5 B Side
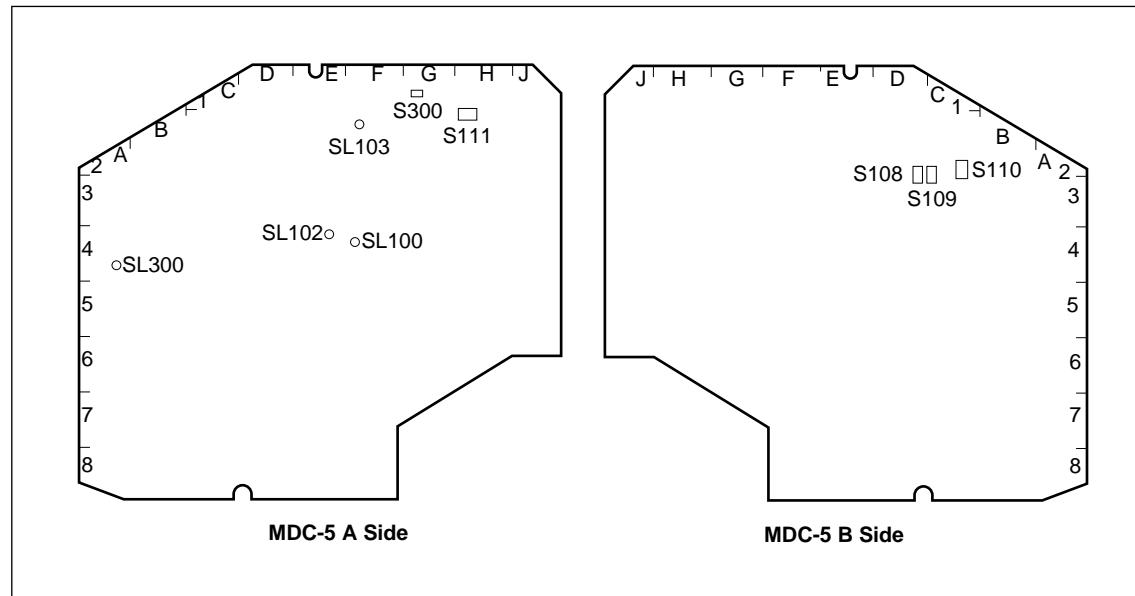
Switches

Ref. No.	Description	Factory setting
S108	Adjustment Mode Select	–
S109	Adjustment Start	–
S110-1	Adjustment Mode ON/OFF	OFF
S110-2	Tracking Adjustment	OFF
S111-1	Board Adjustment Mode OFF/ON	OFF
S111-2	Not used	OFF
S300	Factory use	–

Slit Lands

Ref. No.	Description	Factory setting
SL100	Factory use	SHORT
SL102	Factory use	SHORT
SL103	Factory use	OPEN
SL300	Factory use	SHORT

1-9-7. CT-187 Board

```
          A          B          C
    ┌───────────────────────────────┐
  1 │                    S2    S1    │
    │                   ┌──┐ ┌────┐  │
    │                   │  │ └────┘  │
  2 │                   │  │         │
    │                   └──┘         │
    │                                │
  3 │                                │
    │              S3                │
    │            ┌────┐              │
  4 │            └────┘              │
    │                                │
    │                                │
  5 │                                │
    │                                │
  6 │                                │
    └───────────────────────────────┘
            CT-187 A Side
```
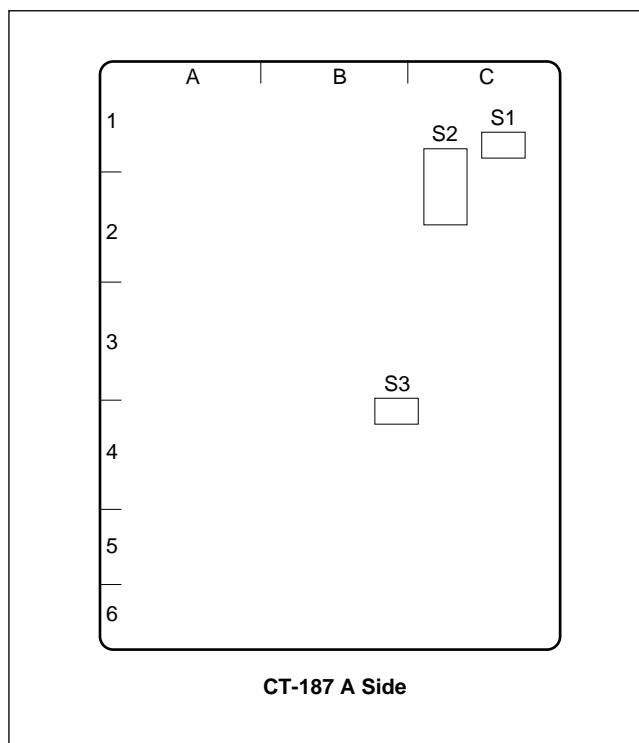
Switches

Ref. No.	Name	Description	Factory setting
S1-1	VF TC Character Select	ON : Displays a time code on the viewfinder usually. OFF : Controls whether to display a time code on the viewfinder by MPU on the CT-187 board usually.	OFF
S1-2	TEST OUT TC Character Select	ON : Outputs a time code character signal to the TEST OUT connector usually. OFF: Controls whether to output a time code character signal on the TEST OUT connector by MPU on the CT-187 board usually.	OFF
S2-1	–	Factory use	OFF
S2-2	Remote Connector	ON : Connects except RM-P9 and VA-DN1. OFF: Connects RM-P9 or VA-DN1.	OFF
S2-3 to 7 -	–	Not used	OFF
S2-8	Data reset	ON : Power on reset in the setting menu.	
S3-1	TEST OUT Character Select	ON : Outputs the character signal to the TEST OUT connector usually. OFF: Outputs no character signal to the TEST OUT connector.	ON
S3-2	VF Character ON/OFF	ON : Displays no character on the viewfinder. OFF: Displays the character on the viewfinder.	OFF

1-9-8. IF-634 Board

IF-634 A Side
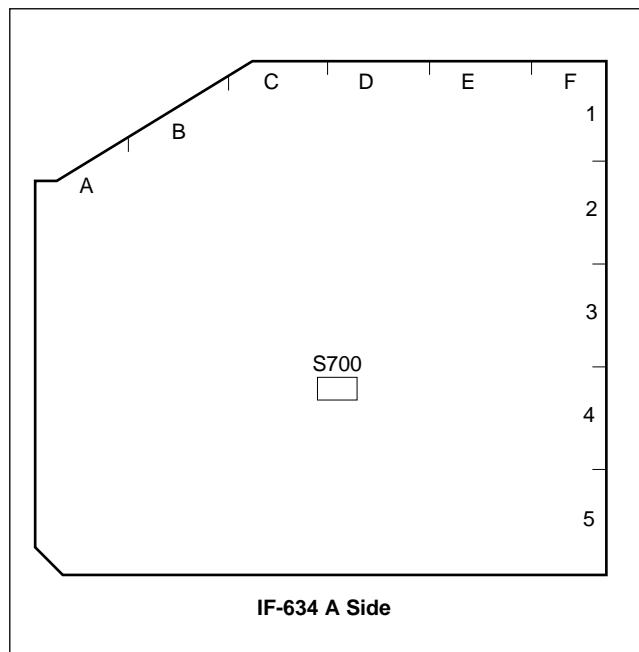
Switches

Ref. No.	Name	Description	Factory setting
S700-1	VF Select	OFF : Color VF ON : Black and white VF	ON
S700-2	–	Factory use	OFF
S700-3 to 8	–	Not used	OFF

1-10. Ejecting the Cassette Tape Manually

Note

Be sure to turn off the power, then pull out the power cord and/or battery before performing the following procedure. If not, damage to internal circuit may result.

1. Open the cover of the outside panel shown in the figure.
2. Turn the gear clockwise while pushing a gear downward until the front lid opens using a Philips screwdriver.
   Then confirm that the tape is taken up the cassette reel.
3. The front lid opens. The cassette tape can then be ejected.

Cover

Turn while pushing (clockwise)

Front lid

If the above operation cannot be executed, perform the following procedure.

1. Remove the front lid and outside panel. (Refer to section 1-6.)
2. Put the cassette compartment into the cassette-up state with the cassette lid of the cassette tape raised. (For more details, refer to section 1-7.)
3. Remove the cassette tape taking care that the tape does not get damage.
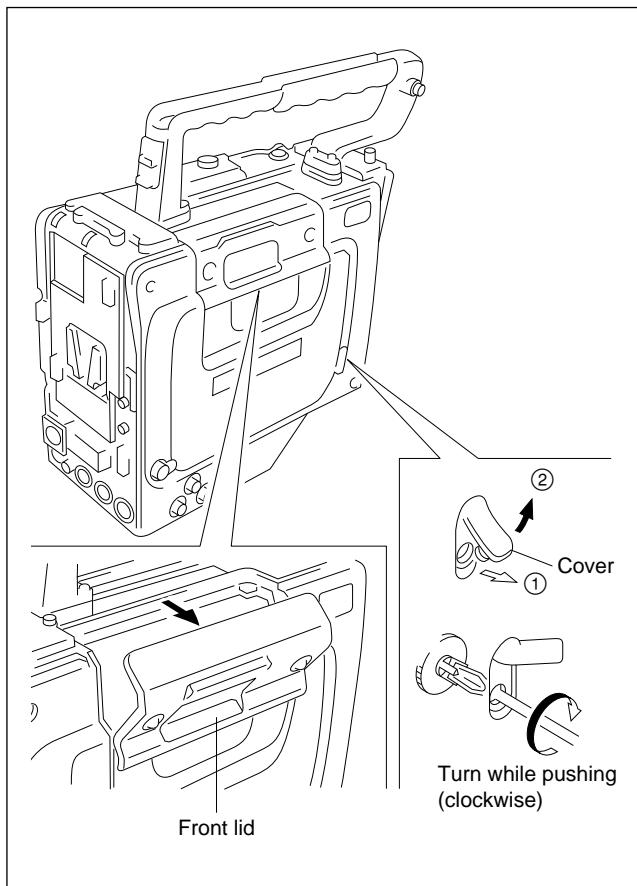
Notes

· Never turn the gear no further after the front lid opened.
· Closing the front lid
   In the state mentioned above, the front lid cannot be closed and locked. Turn on the power, then close the front lid.

1-11. Inserting the Cassette Tape when the Outside Panel is Removed
1-12. Cleaning when the Heads are Clogged
1-12-1. Cleaning by Cleaning Tape

1-11. Inserting the Cassette Tape when the Outside Panel is Removed

1. Place the cassette compartment into the up state. (Refer to section 1-7.)
2. Insert a cassette tape in the cassette compartment.
3. Insert a screwdriver into the hole of cassette compartment shown in the figure, move it in the direction indicated by the arrow until it locks into place.

Note

Never push the lid arm (L) when placing the cassette compartment into the down state.

The lid arm (L) become deformed, and the front cover can not be locked when the outside panel is installed.
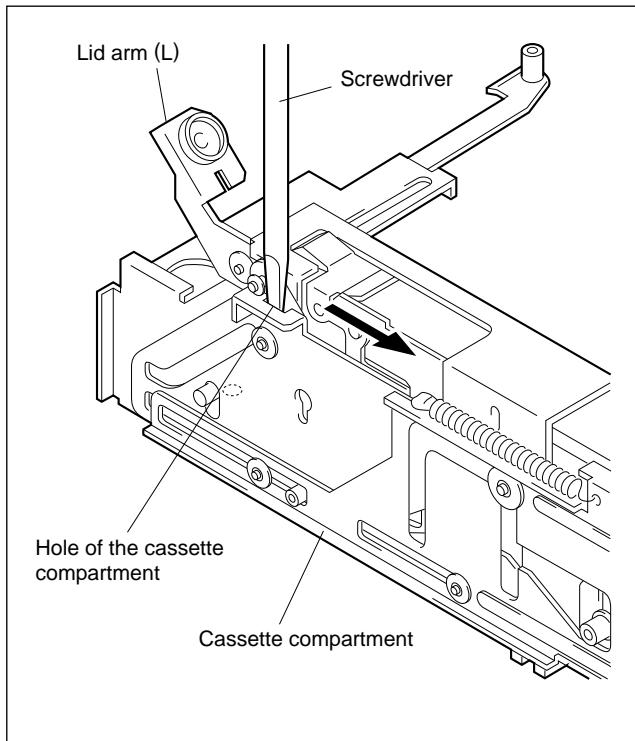
1-12. Cleaning when the Heads are Clogged

If the video heads are clogged, clean the heads as the following procedure.
If the video heads are still clogged after cleaning by the cleaning tape, clean them by cleaning cloth.

1-12-1. Cleaning by Cleaning Tape

Note

Make sure to use the cleaning tape BCT-5CLN. If cleaning is performed by other kind of cleaning tape, unusual wearing or damage of the video heads, may occur.

1. Insert the cleaning tape BCT-5CLN in the unit.
2. Press the PLAY button.
   Head cleaning starts.
3. After 5 seconds, press the EJECT button.
4. The cleaning tape will be eject.

   ### Note

   Be sure to take out the cleaning tape after cleaning to avoid damages to the heads.
5. Confirm that the head clog is clear.

1-12-2. Cleaning by Cleaning Cloth

Notes

- Turn off the power before cleaning.
- Each block in the mechanical deck consist of precision parts and are adjusted precisely. Be careful not to damage each part and to apply an excessive force during cleaning.
- Do not touch the greased portions during cleaning. If grease attaches to a cleaning cloth, replace the cleaning cloth by a new one. If a cleaning cloth smeared with grease is used, grease may attach to the places where it should not.
- Do not insert a cassette tape before a cleaning fluid completely evaporate after cleaning.
- Be sure to rotate the upper drum counterclockwise during cleaning. Clean the upper drum along the circumference. If the upper drum is cleaned in the vertical direction, the rotary heads may be damaged.

Tools

- Cleaning cloth : 3-184-527-01
- Cleaning fluid : 9-919-573-01

Note

Never use a cotton swab to clean the rotary heads.

Cleaning the Video Heads

1. Remove the front lid and outside panel.
    (Refer to section 1-6.)
2. Press the cleaning cloth moistened with cleaning fluid slightly against the position of the rotary heads installation height.

Notes

- Never press the cleaning cloth with wrinkle to the video head during cleaning.
- Keep the cleaning cloth from contact with the rotary heads.

3. Rotate the upper drum slowly in the counterclockwise direction by hands and clean it.
4. After cleaning, wipe the upper drum with dry cleaning cloth.
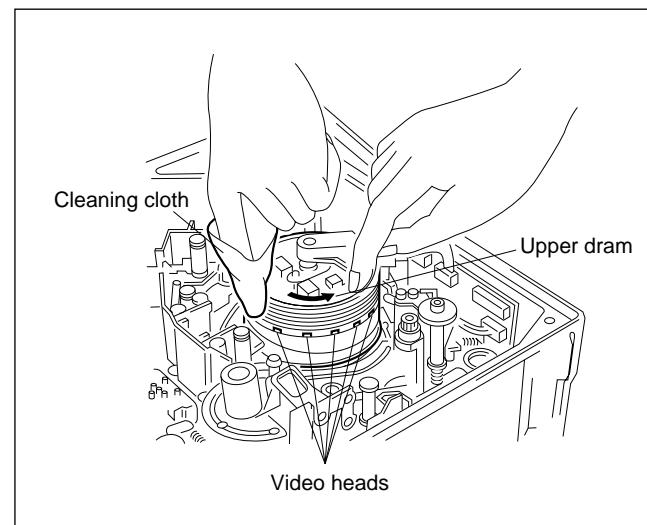

Cleaning the Stationary Heads and Tape Guides

1. Remove the front lid and outside panel.
    (Refer to section 1-6.)
2. Wipe the stationary heads and tape guides using the cleaning cloth moistened with cleaning fluid.
3. After cleaning, wipe the stationary heads and tape guides with dry cleaning cloth.

1-13. 50-pin Connector

The position of the 50-pin connector on the VTR is previously calibrated at the factory with a special tool. If this position is incorrect, the VTR connector cannot make positive contact with the camera or so. Therefore, do not remove the fixing screws of the V connector holder and 50-pin connector except in an emergency.

・ When you check the 50-pin connector portion, remove the C holder cap as shown in the figure.
・ If the lead wire is happened to be open at the 50-pin connector portion, solder the lead wire and contact.

C holder cap
50-pin connector
(−) 2 mm or 3 mm screwdriver
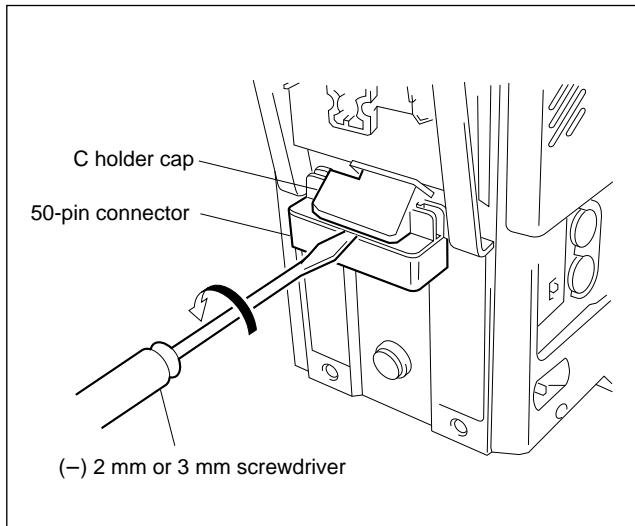
・ If the connector indicates a poor contact with the plug, remove the contact as shown in the figure and replace it with a new one.

Never loosen these screws.
Contact
Lead wire
Push the play with this steel rod.
0.6 mm dia. steel rod
(Replacement procedure)
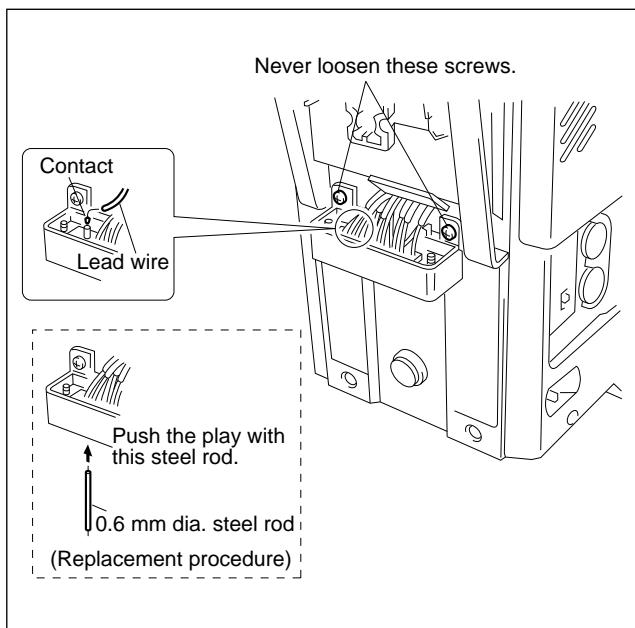
1-14. Backup Battery

The lithium battery for data backup operation is mounted on the TC-80 board. Replace the lithium battery every five years. For more details of the replacement, refer to "1-3. Lithium Battery Replacement" of the Maintenance Manual Part 2 Vol-1.

1-15. Removal/Installation of Flexible Card Wires

Notes

・ Be sure to turn off the power, then pull out the power cord and/or battery before performing the following procedure. If not, damage to internal circuit may result.
・ Two 30-pin flexible card wires are used between the MB-627 and the TC-80 boards. Be careful not to break these flexible card wires. This shortens the wire life.

Removal

Slide portions A in the direction indicated by the arrow, unlock it, then pull out the flexible card wire.

Portions A
Flexible card wire
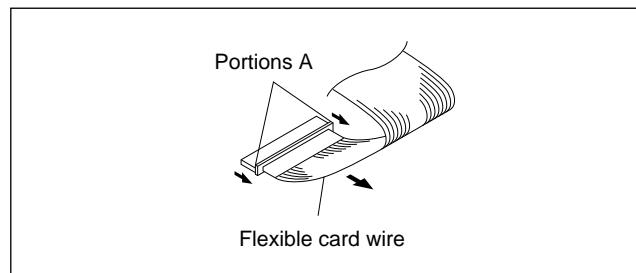
Installation

1. Check that the conductive surface of the flexible card wire is not soiled with dust.
2. Slide portions A in the direction indicated by the arrow and insert the flexible card wire tightly into each connector with the conductive surface of these wires put down.

   Note

   Be careful not to insert the flexible card wires obliquely.
3. Slide portions A in the reverse direction of the arrow and lock each connector.

1-16. Fixtures

1-16-1. Extension Boards

Extension boards are optionally available to check and adjust the boards in the table below. Use the extension boards in the procedure below, then perform to check and adjust the boards.

Extension board	Board to be checked and adjusted
EX-501	DVP-1, DVP-2, IF-634, CT-187
EX-541, EX-542	MDC-5

Using the EX-501 board

1. Remove the board to be extended (DVP-1or IF-634 board).
2. Connect the EX-501 board to the connector on the MB-627 board.
3. Connect the board (DVP-1 or IF-634) to be extended to the EX-501 board.

Note

When to remove the connected board from the EX-501 board, insert the tip of a flat-blade screwdriver into the section marked with "EJECT", turn the screwdriver, and remove the board.
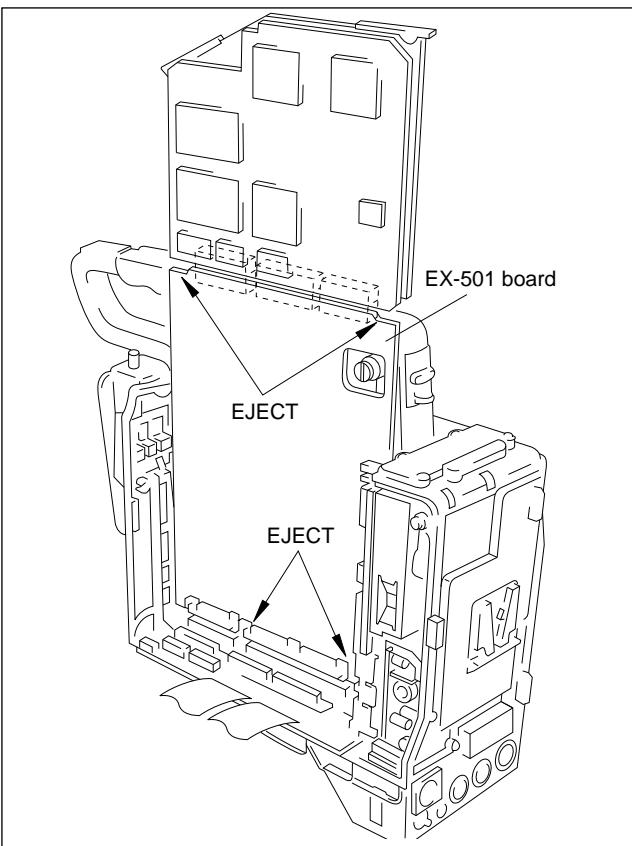
Using the EX-541 and EX-542 boards

1. Remove the DVP-1 and IF-634 boards.
2. Remove the eight screws, then remove the shield cover on the MDC-5 board.
3. Connect the EX-541board to connectors CN3 and CN4 on the MB-627 board.
4. Connect the EX-542 board to connectors CN1 and CN2 on the MB-627 board.
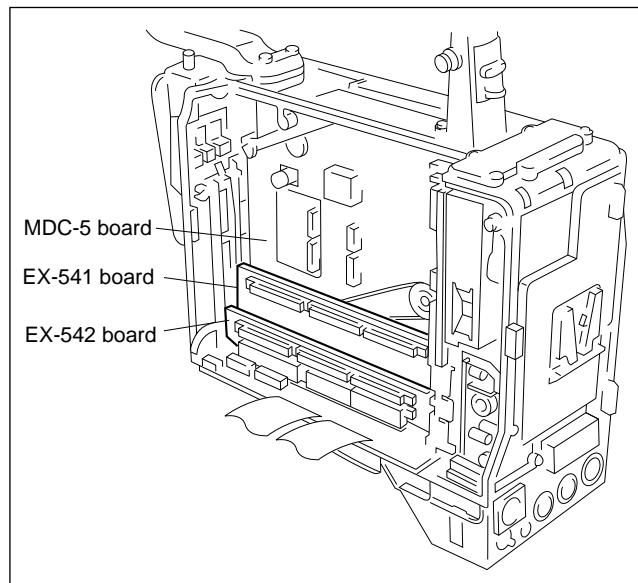
5. Connect the DVP-1 board to the EX-541 board.
6. Connect the IF-634 board to the EX-542 board.
7. Install the two stays in the hooks and fix the DVP-1 and IF-634 boards shown in the figure.

Note

When to remove the connected boards from the EX-541 and EX-542 boards, insert the tip of a flat-blade screwdriver in the section marked with "EJECT", turn the screwdriver, and remove the board.
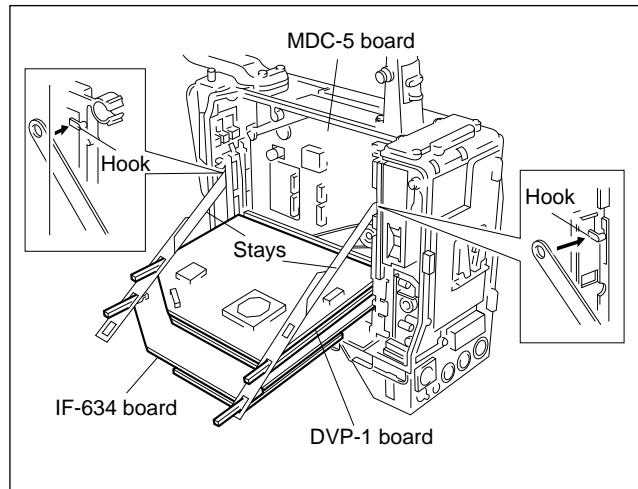
1-16-2. Fixtures

| Fig No.	Part No.	Description	For use
1	A-8312-292-A	TP Tool	Video tracking adjustment
2	A-8312-804-A	Extension Board Assembly (EX-501/541/542, Stays)	Plug-in board check/adjustment
3	J-6035-070-A	IC External Tool (ICT-2101)	Extraction of IC (PLCC type)
4	J-6080-840-A	Inspection Mirror	Video tracking adjustment
5	J-6152-450-A	Wire Clearance Check Gauge	Clearance check
6	J-6322-420-A	Tape Guide Adjustment Driver (45)	Tape path adjustment
	J-6322-420-3	TG Driver Spare Bit (45)	
7	J-6323-530-A	Stop Washer Fastening Tool	Installation of stop washer
8	J-6323-890-A	FWD Back Tension Measuring Cassette	FWD back tension adjustment
9	J-6324-150-A	Reel Table Height Adjustment Tool	Reel height adjustment
10	J-6325-110-A	Torque Driver Bit (for M1.4)	Tightening screws
	J-6325-380-A	Torque Driver Bit (For M2)	
11	J-6325-400-A	Torque Driver Bit (For 3 kg)	
12	J-6326-120-A	Hexagonal Bit	
13	J-7032-610-A	Cassette Reference Plate	Reel height adjustment
14	3-703-358-08	Parallel Pin	Mechanical adjustment
15	3-184-527-01	Cleaning Cloth	Cleaning
16	7-651-000-10	Grease, SGL-601 (50g)	Lubricant
	7-651-000-11	Grease, SGL-801 (50g)	
17	7-661-018-18	Oil	
18	7-700-736-05	Hexagonal Wrench (d = 1.5 mm)	Removal of screws
19	8-960-075-01	Alignment Tape, SR5-1	Digital video/audio adjustment (NTSC)
	8-960-075-11	Alignment Tape, SR2-1	Video tracking adjustment (NTSC)
	8-960-075-51	Alignment Tape, SR5-1P	Digital video/audio adjustment (PAL)
	8-960-075-61	Alignment Tape, SR2-1P	Video tracking adjustment (PAL)
20	9-919-573-01	Cleaning Fluid	Cleaning
–	7-432-114-11	Screw Locking Compound	
–	Product	Blank Tape, BCT-30MA or Betacam SX Video Cassette, BCT-60SX	For recording
		Cleaning Tape, BCT-5CLN	Cleaning

1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
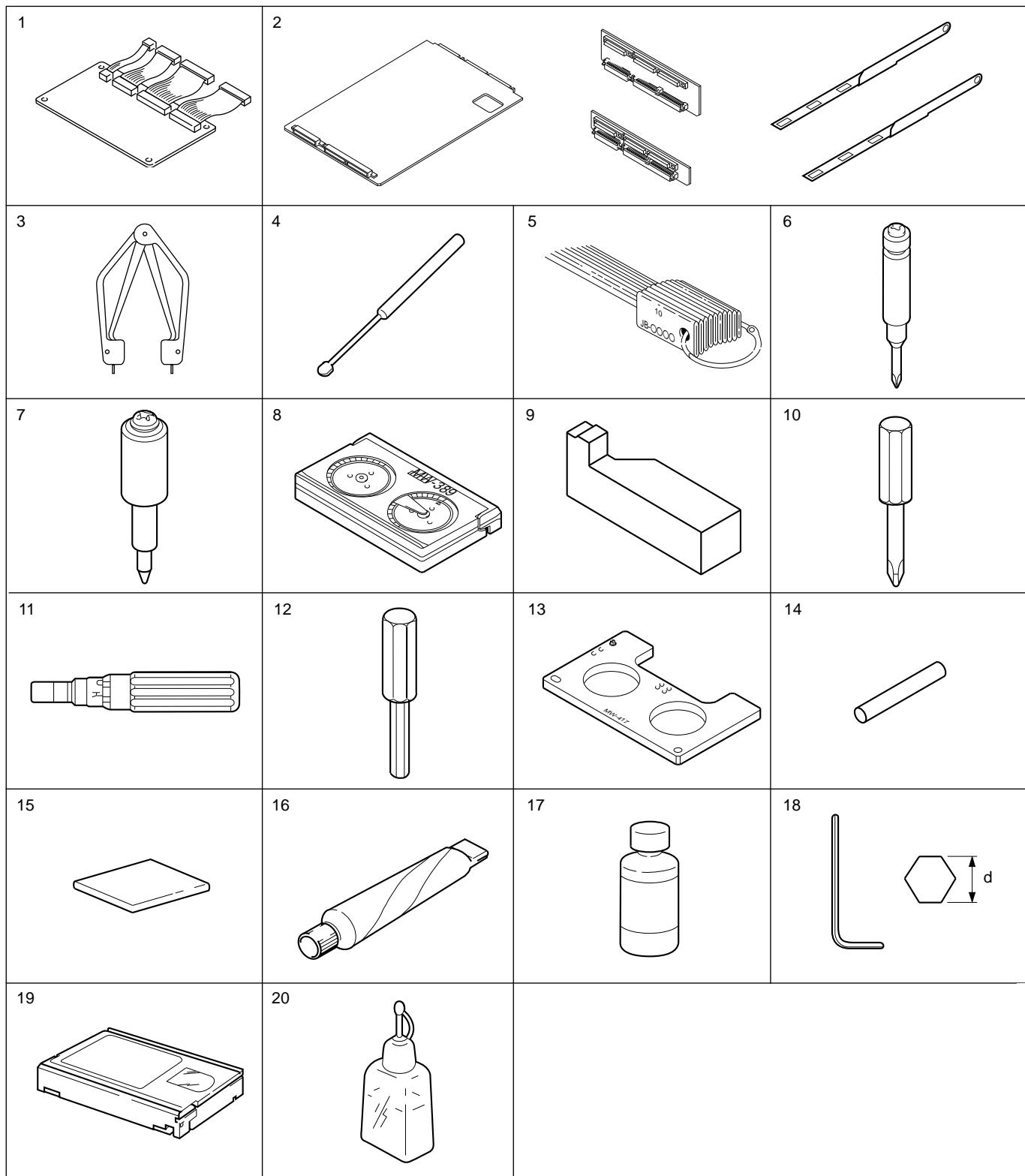
Section 2
Error Code

2-1. Error Code

Error code

Warning indicators

LCD displays
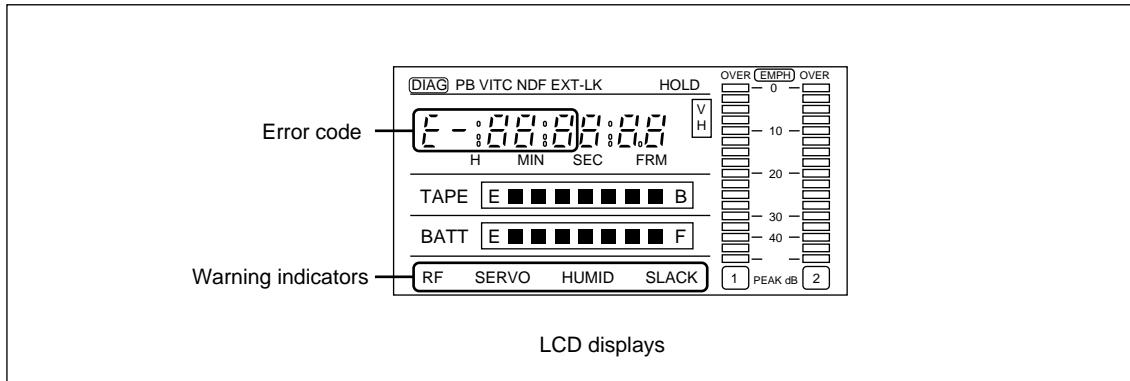
2-1-1. Warning Indicators

The warning indicator on the LCD screen lights if any fault occurs during the power-on sequence or normal operation. And the tally indicator on the viewfinder, back tally and warning indicators blink at the same time.

RF : Lights if video heads are clogged.
SERVO : Lights if the servo fails.
Lights if the communication error is occurred between system control IC (DVP-1 board) and servo IC (MDC-5 board)
HUMID : Lights if there is condensation in the unit.
SLACK : Lights if the tape is not winding properly or the following troubles
(refer to "Error Codes") are occurred.

2-1-2. Error Codes

When "SLACK" of the warning indicator lights, error causes and its operating status are displayed on the LCD display.

E-X X X

Mode
- *l*: REC
- *2*: REC PAUSE
- *3*: THREAD
- *4*: UNTHREAD
- *5*: STOP
- *8*: PLAY
- *9*: FF
- *A*: REW
- *b*: REC REVIEW
- *C*: CUE UP
- *E*: FF SEARCH
- *F*: REW SEARCH

Error cause
- *10*: Drum drive voltage abnormality
- *11*: Detects no drum FG
- *12*: Detects no drum PG
- *20*: Capstan drive voltage abnormality
- *21*: Detects no capstan FG-A
- *22*: Detects no capstan FG-B
- *23*: Capstan rotation abnormality in forward and reverse directions
- *24*: Capstan speed abnormality (high speed)

- *32*: Detects no S reel FG
- *42*: Detects no T reel FG
- *61*: Fuction cam rotation overtime in the forward direction
- *62*: Fuction cam rotation overtime in the reverse direction
- *63*: Tape top sensor overtime
- *70*: Servo NVRAM checksum error
- *71*: Communication error between servo CPUs

SECTION 3
MAINTENANCE MODE

3-1. DIAG Menu

The DIAG menu is used for the maintenance menu setting and troubleshooting of the DNV-5.

| Notes |
- Use the DIAG menu in the state in which the tape transport stopped.
- Do not execute the DIAG menu when remote control RM-P9 is connected. The self-diagnosis function and remote control function are not normally activated when the self-diagnosis is executed.

Operation
1. DIAG menu activation
    Push the DIAG switch on the inside panel with the tip of a clip so as to display the DIAG menu on the LCD display.

2. PAGE selection
    Press the ADVANCE button and select the PAGE.
       To increment the menu number, press the ADVANCE button.
       To decrement the menu number, press the ADVANCE and HOLD buttons simultaneously.
    After selection, Press the SHIFT button.
    Select the PAGE repeatedly until the desired ITEM is found.

3. ITEM selection
    Press the ADVANCE button and select the ITEM.
    After selection, press the SHIFT button.

4. ITEM setting
    Press the ADVANCE button to change the set value.
    After change, press the SHIFT button.

5. DIAG menu termination
    Press the DIAG switch.

LCD

```
┌─────────────────────┐
│ X X                 │
└─────────────────────┘
    ↑  ↑
    │  └──────────────────────┐
    │                         │
─── 0:HOURS METER ─────────── 1:DRUM RUNNING
                            ── 2:TAPE RUNNING
                            ── 3:OPERATION
                            ── 4:THREADING
─── 1:TIME SET              ── 5:DRUM RUN-2
─── 2:DATE SET              ── 6:TAPE RUN-2
─── 3:BAT BEF END           ── 7:OPERATION-2
─── 4:BAT END               ── 8:THREADING-2
─── 5:VITC LINE
─── 6:VTR MODE SELECT ────── 1:VTR MODE SELECT-1 ─── V/AU OUT
                                                  ── AU OUT (F/R)
                                                  ── AU OUT CH
                                                  ── AU REC CH3/4

                          ── 2:VTR MODE SELECT-2 ─── AU REC EMPH
                                                  ── AU SG (1kHz)
                                                  ── AU SG LEVEL
                                                  ── AU ADAPTER

                          ── 3:VTR MODE SELECT-3 ─── TC OUT
                                                  ── EXT-LK UBIT
                                                  ── EXT-LK DF/NDF
                                                  ── WATCH AUTO ADJ
                                                  ── UB WATCH MIX

                          ── 4:VTR MODE SELECT-4 ─── REC TALLY BLINK
                                                  ── LIGHT OFF NEAR END

                          ── 5:VTR MODE SELECT-5 ─── REC START/STOP TONE
                                                  ── AUTO SHOT NO RESET
                                                  ── SHOT TIME DISP

                          ── 6:VTR MODE SELECT-6 ─── LTC UBIT
                                                  ── LTC UBIT MARKER
                                                  ── REC START MARKER
                                                  ── SHOT MARKER1
                                                  ── SHOT MARKER2

                          ── 7:VTR MODE SELECT-7 ─── VITC UBIT
                                                  ── UB DATA

                          ── 8:VTR MODE SELECT-8 ─── NTSC/PAL SW
                                                  ── DF/NDF
                                                  ── RE SW AS RETURN
                                                  ── VTR SAVE
─── 7:WATCH REVISION
─── 8:LCD/LED CHECK
─── 9:SLACK DATA ─────────── 1:SLACK DATA 1
                          ── 2:SLACK DATA 2
                          ── 3:SLACK DATA 3
                          ── 4:SLACK DATA 4

─── D:PB EQ DATA ─────────── 1:PB EQ A-CH DATA
                          ── 2:PB EQ A-CH DATA
                          ── 3:PB EQ B-CH DATA
                          ── 4:PB EQ B-CH DATA
                          ── 5:PB EQ C-CH DATA
                          ── 6:PB EQ C-CH DATA
                          ── 7:PB EQ D-CH DATA
                          ── 8:PB EQ D-CH DATA

─── E:REC CURRENT DATA ───── 1:REC CURRENT DATA 1
                          ── 2:REC CURRENT DATA 2

─── F:PB VIDEO DATA ──────── 1:PB VIDEO DATA

─── G:REC VIDEO DATA ─────── 1:REC VIDEO DATA 1
                          ── 2:REC VIDEO DATA 2
                          ── 3:REC VIDEO DATA 3 (NTSC only)
```

LCD Display (factory setting)	Description

DIAG 0

HOURS METER   The contents below are displayed. (For more details, refer to 6-3-1, "Hours Meter".)

```
┌─────────────────┐
│ 0 X    X X X X  │
└─────────────────┘
    ↑
```
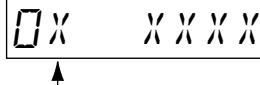
1. DRUM RUNNING	....	Total drum rotating hours
2. TAPE RUNNING	....	Total tape running hours
3. OPERATION	....	Total power-on time
4. THREADING	....	Total number of threading
5. DRUM RUN-2	....	Drum rotating hour (Customer-resetable)
6. TAPE RUN-2	....	Tape running hour (Customer-resetable)
7. OPERATION-2	....	Power-on time (Customer-resetable)
8. THREADING-2	....	The number of threading (Customer-resetable)

DIAG 1

TIME   Internal timer setting.

                                      1. Sets the hour.

```
┌─────────────────┐
│ 1  X X X X X X  │
└─────────────────┘
     ↑   ↑   ↑
     1   2   3
```

     2. Sets the minute.

     3. Sets the second.
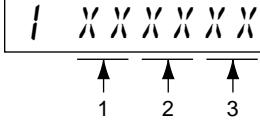
DIAG 2

DATE   Internal timer date setting.

     1. Sets the month (for NTSC) /day (for PAL).

```
┌─────────────────┐
│ 2  X X X X X X  │
└─────────────────┘
     ↑   ↑   ↑
     1   2   3
```

     2. Sets the day (for NTSC) /month (for PAL).

     3. Sets the year.
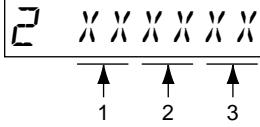
DIAG 3

BATTERY VOLTAGE   Displays and sets the battery before end voltage.
(For the setting, refer to the Operation Manual.)

BEFORE END   Battery before end voltage setting

```
┌─────────────────┐
│ 3       1 1.3   │
└─────────────────┘
```

     11.0 to 13.0 V (in units of 0.1 V)
     "0" is displayed on the LCD when the setting is OK.
     "E" is displayed on the LCD when the setting is NG.

DIAG 4

BATTERY VOLTAGE   Displays and sets the battery end voltage. (For the setting, refer to the Operation Manual.)

END   Battery end voltage setting
     10.5 to 11.5 V (in units of 0.1 V)

```
┌─────────────────┐
│ 4       1 1.0   │
└─────────────────┘
```

     "0" is displayed on the LCD when the setting is OK.
     "E" is displayed on the LCD when the setting is NG.

DIAG 5

VITC INSERT LINE   Displays and sets the VITC insertion line.

     12 to 19 lines (For NTSC)

```
┌─────────────────┐
│ 5      16 18    │
└─────────────────┘
        └──┐ └─── NEXT LINE
           └───── FIRST LINE
```

     9 to 22 lines (For PAL)

LCD Display (factory setting)	Description

DIAG 6-1

VTR MODE SEL-1

```
6 1  0000
    ↑ ↑ ↑ ↑
    1 2 3 4
```

1. V/AU OUT : Sets the video and audio output.

    0 : Outputs the PB/EE signal.
    1 : Outputs the EE signal.

2. AU OUT (F/R) : Sets the audio output during FF/REW.
   (Valid when V/AU OUT is set to 0.)

    0 : Outputs the EE signal.
    1 : Outputs no signal.

3. AU OUT CH : Sets the audio output channel.

    0 : CH1/2
    1 : CH3/4

4. AU REC CH3/4 : Selects the source during recording in CH3/4.

   (Valid when no camera adapter (CA-701) is connected or when AU ADAPTER ENABLE is disabled.)

    0 : Front MIC input (CH3) and wireless receiver input (CH4).
    1 : Records the same signal as in CH1/2.
    2 : Not use CH3/4.

DIAG 6-2

VTR MODE SEL-2

```
6 2  0000
    ↑ ↑ ↑ ↑
    1 2 3 4
```

1. AU REC EMPH : Sets the audio emphasis (during recording) to ON or OFF.

    0 : OFF
    1 : ON

2. AU SG (1 kHz) : Sets whether to generate a 1 kHz test signal when a color-bar signal is generated from the internal signal generator.

    0 : Not generates.
    1 : Generates when the CH1 AUDIO SELECT switch on the inside panel is set to AUTO.
    2 : Generates.

3. AU SG LEVEL : Sets the level of a 1 kHz test signal.

    0 : -20 dBu (600 Ω)
    1 : -18 dBu (600 Ω)
    2 : -16 dBu (600 Ω)

4. AU ADAPTER : Sets whether to connect the camera adapter (CA-701).

    0 : Connects.
    1 : Not connect.

LCD Display (factory setting)	Description

DIAG 6-3

VTR MODE SEL-3

```
63 00000
   ↑ ↑ ↑ ↑ ↑
   1 2 3 4 5
```

1. TC OUT : Sets the time code output.

    0 : Outputs PB/TCG.
    1 : Outputs TCG.

2. EXT-LK UBIT : Sets the LTC UB set value when the time code is locked externally.

    0 : Internally set value
    1 : External LTC value

3. EXT-LK DF/NDF : Sets the DF/NDF (NTSC only).

    0 : Conforms to the DF/NDF switch setting on the inside panel.
    1 : Conforms to the external LTC setting.

4. WATCH AUTO ADJ : Sets the internal timer automatic time correction (according to the user's bit of the unit connected to TC OUT).

    0 : Corrects.
    1 : Not correct.

5. UB WATCH MIX : Sets whether to output the time of an internal timer to the LTC UB.

    0 : Not output.
    1 : Outputs.

DIAG 6-4

VTR MODE SEL-4

```
64 00
   ↑ ↑
   1 2
```

1. REC TALLY BLINK : Sets whether the TALLY lamp blinks during battery before end and tape before end.

    0 : Blinks.
    1 : Lights.

2. LIGHT OFF NEAR END : Sets whether to turn off the light during battery before end.

    0 : Turns off forcibly.
    1 : Not turn off.

DIAG 6-5

VTR MODE SEL-5

```
65 000
   ↑ ↑ ↑
   1 2 3
```

1. REC START/STOP TONE : Sets whether to output a sound when the REC START/STOP button is pressed.

    0 : Outputs no sound.
    1 : Outputs a sound.

2. SHOT NO. RESET : Sets whether to reset the shot number automatically during tape-threading.

    0 : Resets automatically.
    1 : Not reset.

3. SHOT TIME DISP : Sets the format of the time displayed on the LCD.

    0 : Month Day : Hour Minute
    1 : Day Month : Hour Minute
    2 : Day : Hour Minute Second

LCD Display (factory setting)	Description

DIAG 6-6

VTR MODE SEL-6

```
66 00000
   ↑ ↑ ↑ ↑ ↑
   1 2 3 4 5
```

1. LTC UBIT : Sets the data recorded in the user bits of LTC.

    0 : Fixed data (Conventional-type user bits)
    1 : Time of internal timer (in real time)
    2 : Shot data

2. LTC UB-MARKER : Sets whether to write the mark below in the user bits of LTC.
    REC start mark
    Shot mark 1
    Shot mark 2

    0 : Conform to the menu setting below.
    1 : Writes all marks.
    2 : Writes nothing.

3. REC START MARKER
    (Valid when the LTC UB-maker is set to SW.)

    0 : Writes.
    1 : Not write.

4. SHOT MARKER 1
    (Valid when the LTC UB-marker is set to SW.)

    0 : Writes.
    1 : Not write.

5. SHOT MARKER 2
    (Valid when the LTC UB-marker is set to SW.)

    0 : Writes.
    1 : Not write.

DIAG 6-7

VTR MODE SEL-7

```
67 00
   ↑ ↑
   1 2
```

1. VITC UBIT : Sets the data recorded in the user bits of VITC.

    0 : Fixed data (Conventional-type user bits)
    1 : Time of internal timer (in real time)
    2 : Shot data

2. SHOT DATA : Sets the data length of the VITC shot data.

    0 : Record data of date, time, model ID, serial No., cassette No., shot No.
    1 : Record data of date, time, model ID, serial No., cassette No., shot No.,
       shot ID 1 to 4.

DIAG 6-8

VTR MODE SEL-8

```
68 0000
   ↑ ↑ ↑ ↑
   1 2 3 4
```

1. NTSC/PAL SW : Sets the NTSC or PAL systems.

    0 : Conforms to the NTSC/PAL switch setting on the inside panel.
    1 : NTSC
    2 : PAL

2. DF/NDF : Sets the DF or NDF. (Valid for NTSC only.)

    0 : Drop frame
    1 : Non-drop frame

3. RE SW AS RETURN : Sets whether to use the rotary encoder as the record start switch
                of a shot marker.

    0 : Uses.
    1 : Not use.

4. SAVE : Sets whether to effect the SAVE switch.

    0 : Effects.
    1 : Not effect.

LCD Display (factory setting)	Description

DIAG 7

WATCH REVISION

Sets the corrected value of an internal timer (the number of frames a day).

```
7      X X X
```

DIAG 8

LCD/LAMP CHECK

Sets the LCD and LED light check.

All the lamps are turned on or off every time the SHIFT button is pressed.

```
8
```

DIAG 9

```
9 X    X X X X
```
STATE CODE
TROUBLE CODE

1. SLACK DATA 1 .... Slack trouble code 1 (latest)
Slack state code 1 (latest)

2. SLACK DATA 2 .... Slack trouble code 2
Slack state code 2

3. SLACK DATA 3 .... Slack trouble code 3
Slack state code 3

4. SLACK DATA 4 .... Slack trouble code 4
Slack state code 4

・Contents of slack trouble code

10 : Abnormal drum drive voltage
11 : No drum FG output
12 : No drum PG output
20 : Abnormal capstan drive voltage
21 : No capstan FG-A output
22 : No capstan FG-B output
23 : Abnormal forward/reverse rotation of capstan
24 : Abnormal capstan speed (high-speed)
32 : No S reel FG output
42 : No T reel FG output
61 : Time over the forward rotation time of function cam
62 : Time over the reverse rotation time of function cam
63 : Time over the tape top sensor
64 : Time over the full top sensor
65 : Time over the end sensor time
70 : Servo NVRAM checksum error
71 : Communication error between servo CPUs

・Contents of slack state code

00 : Power-on initialization
1x : No cassette and standby state
2x : Record
3x : Stop
4x : FF/REW
5x : Playback
6x : REC PAUSE
7x : REC REVIEW
8x : Threading/unthreading

LCD Display (factory setting)	Description

DIAG D-1

PG EQ ADJ DATA-1   Displays the equalizer adjustment data (A-CH).

```
d IXXXXXX
   ↑   ↑   ↑
   1   2   3
```
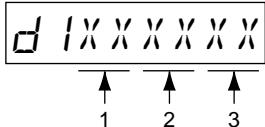
    1. A-CH FREQ

    2. A-CH PHASE

    3. A-CH GAIN

DIAG D-2

PG EQ ADJ DATA-2   Displays the equalizer adjustment data (A-CH).

```
d2    XXXX
      ↑   ↑
      1   2
```
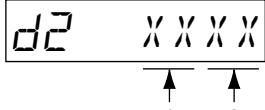
    1. A-CH ENV

    2. A-CH PLL

DIAG D-3

PG EQ ADJ DATA-3   Displays the equalizer adjustment data (B-CH).

```
d3XXXXXX
  ↑   ↑   ↑
  1   2   3
```
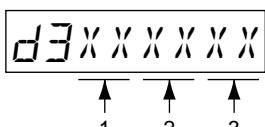
    1. B-CH FREQ

    2. B-CH PHASE

    3. B-CH GAIN

DIAG D-4

PG EQ ADJ DATA-4   Displays the equalizer adjustment data (B-CH).

```
d4    XXXX
      ↑   ↑
      1   2
```
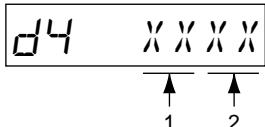
    1. B-CH ENV

    2. B-CH PLL

DIAG D-5

PG EQ ADJ DATA-5   Displays the equalizer adjustment data (C-CH).

```
d5XXXXXX
  ↑   ↑   ↑
  1   2   3
```
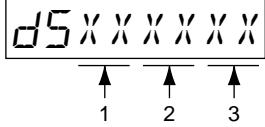
    1. C-CH FREQ

    2. C-CH PHASE

    3. C-CH GAIN

DIAG D-6

PG EQ ADJ DATA-6   Displays the equalizer adjustment data (C-CH).

```
d6    XXXX
      ↑   ↑
      1   2
```
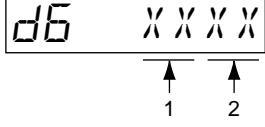
    1. C-CH ENV

    2. C-CH PLL

LCD Display (factory setting)	Description

DIAG D-7

PG EQ ADJ DATA-7

```
d7 X X X X X X
   ↑   ↑   ↑
   1   2   3
```

Displays the equalizer adjustment data (D-CH).

    1. D-CH FREQ

    2. D-CH PHASE

    3. D-CH GAIN
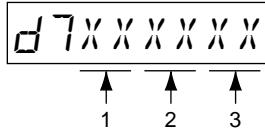
DIAG D-8

PG EQ ADJ DATA-8

```
d8    X X X X
      ↑   ↑
      1   2
```

Displays the equalizer adjustment data (D-CH).

    1. D-CH ENV

    2. D-CH PLL
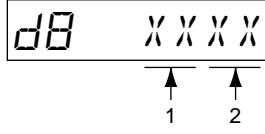
DIAG E-1

REC CURRENT DATA-1

```
E1    X X X X
      ↑   ↑
      1   2
```

Displays the REC current adjustment data.

    1. A-CH

    2. B-CH
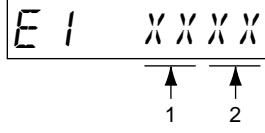
DIAG E-2

REC CURRENT DATA-2

```
E2    X X X X
      ↑   ↑
      1   2
```

Displays the REC current adjustment data.

    1. C-CH

    2. D-CH
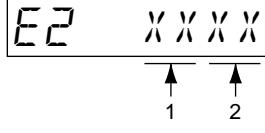
DIAG F

PB VIDEO ADJ DATA

```
F     X X X X
      ↑   ↑
      1   2
```

Displays the PB video adjustment data.

    1. VIDEO LEVEL

    2. INT BURST FRQ
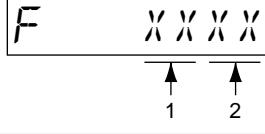
DIAG G-1

REC VIDEO ADJ DATA-1

```
G1 X X X X X X
   ↑   ↑   ↑
   1   2   3
```

Displays the REC video adjustment data.

    1. Not used

    2. R-Y DELAY

    3. B-Y DELAY
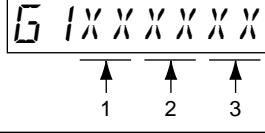
DIAG G-2

REC VIDEO ADJ DATA-1

```
G2 X X X X X X
   ↑   ↑   ↑
   1   2   3
```

Displays the REC video adjustment data.

    1. Y LEVEL

    2. R-Y LEVEL

    3. B-Y LEVEL
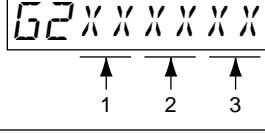
Section 4
Block Diagram and Outline of Circuit

Outline of Circuit

(1) Video input system and digital signal system (DVP-1 (1/2) board, DVP-2 board, IF-634 board, and drum assembly)

・ Signal processing during recording
The Y/R-Y/B-Y signals supplied from the camera are A/D converted. The A/D converted R-Y and B-Y signals are multiplexed and produce the C signal, and the resultant C signal and Y signal are multiplexed by a TBC buffer. In the PAL mode, setup of the parallel video data output from the TBC buffer is removed.
The parallel video data is compressed to a data rate of approximately 1/10 using an SX encoder after the VITC signal is added. The compressed video data is input to the ECC encoder where an outer ECC is added to the video data and the compressed video data is track-interleaved.
The serial audio data (A/D DATA 1/2 and 3/4) supplied from the TC-80 board is also input to the ECC encoder where an outer ECC is added and the audio data is field-shuffled. The video data and audio data are multiplexed and are inner-ECC-encoded by the ECC encoder. The resultant data is then sent to the drum as the four-channel parallel record data.
The Betacam SX recorder records the video and audio signals on magnetic tape in a Betacam SX format.
The Betacam SX recorder uses the four rotary heads which have an azimuth angle in the opposite direction to each other, and are paired. Every rotation of the drum records the four helical tracks. Every five rotations of the drum i.e., the twenty helical tracks record the four frame data.
＊ The Betacam SX format of the PAL system records the two frame data with three rotations, i.e., twelve helical tracks.

・ Signal processing during playback
The four-channel parallel PB data supplied from the drum is inner-corrected by the inner ECC decoder. The parallel PB data is then deinterleaved and sent to the outer ECC decoder where the video data is outer-corrected and sent to the SX decoder.
The SX decoder performs the bit rate reduction decoding of the playback video data so that the original data rate is restored. The errors that cannot be corrected by the ECC decoder are sent to the memory where separate error correction scheme is performed.
The playback parallel video data is then D/A converted and produce the VBS signal.
The VBS signal feeds the VBS OUT connector, and also feeds the TEST OUT connector and viewfinder after a character signal is added.
Audio data is outer-corrected, error-corrected, then converted of its clock rate using FIFO memory. The audio data is sent to the audio data processor in the form of two-channel serial audio data (CONFI AU 1/2 and 3/4).
The NTSC Betacam SX system is equipped with a five-field sequence generator which controls the five-field sequence of playback audio data.

The digital data processing in each IC is performed under communication with the system control CPU.

(2) Audio system (AXM-14 board (1/2), CNB-1 board (1/2), TC-80 board (1/2), and RX-26 board)

The audio system of the Betacam SX recorder has the configuration of the four input channels with the two output channels.

The CH-1 and CH-2 have the "AUDIO IN" switches which select their input signals from either the LINE/MIC input (rear input) signals coming from the XLR connectors on the rear panel, or the camera MIC input signal (CH-3) coming from the camera, or the wireless audio input signal (CH-4) coming from the slot-in wireless receiver, to be recorded on tape.

The selected input signal is A/D converted and sent to the audio data processor as the AU A/D data (1/2 and 3/4). The output signal from the audio data processor is D/A converted, and the CH-1 and CH-2 signals are output from the 5-pin XLR connector.

The earphone and internal speaker have the "MONITOR" switch which selects either CH-1, MIX, or CH-2 signal to be output the earphone and internal speaker.

(3) System control (DVP-1 board (2/2), TC-80 board (2/2), KY-293 board, HN-224 board (1/2), and AXM-14 board (2/2))

Among the captioned circuit boards of the system control block, the DVP-1 board controls its peripheral boards and the entire system, while the TC-80 board controls the system unique to the machine such as time code, display, and key panel. The CT-187 board controls the analog video input and output systems.

• DVP-1 board (2/2)

The DVP-1 board (2/2) has the system control CPU that is the center of the system control. A 16-bit CPU operating on a clock speed of 20 MHz, is used for the system control CPU because it handles large volume of data in such a case as communication with digital processors. Regarding communication, the parallel interface of the DVP-1 board is established after level-shift (from $5V \rightarrow 3.3$ V) because the parallel bus interface system such as digital processor ICs, operates on 3.3 V. The serial interface system can be interfaced directly with the SIO of the CPU. However, because the CPU must establish serial communication with the SERVO MPU and TC MPU in addition to the SIO of the CPU, the SIO is shared and is switched to either SCI (DPR) or SCI (SV) or SCI (TC) by the SCI selector.

For the serial communication with the CT MPU, another SIO is used for interface because the CT MPU uses the different type of synchronization systemfrom VTR block. An I/O expander covers an insufficient numbers of the I/O port.

• TC-80 board (2/2)

The TC MPU on the TC-80 board (2/2) controls TC IC (LTC reader and generator) while communicating with the system control CPU in serial communication. The TC MPU also controls the LCD module, key matrix, and character generator via the I/O expander.

A backup power supply using a lithium battery is used to back up the generator circuit and real-time data.

• CT-187 board

The CT MPU on the CT-187 board controls superimpose of the menu and short data, VTR REMOTE terminal communication, and analog video input and output.

(4) Servo control block (MDC-5 board and HN-224 board (2/2))

・ MDC-5 board
The MDC-5 board has the two MPUs. MPU1 controls the mode control and capstan servo system while communicating with the system control CPU in serial communication. MPU2 controls the drum servo system while interfacing with MPU1.
The drum motor and capstan motor are controlled by the PWM switching drive of the feedback servo systems between FG and PG pulses and between FG and CTL pulses, respectively. The threading motor is controlled by a bidirectional motor driver.

(5) Power supply system (CNB-1 board (2/2), RE-118 board, and RE-119 board)

・ CNB-1 board (2/2)
The input DC 12 V from the battery pack or DC IN connector is input to the CNB-1 board (2/2) where the input 12 V passes through a circuit breaker, is turned on or off by the "POWER" switch and is output as an UNREG +12 V.
This output voltage is sent not only to the camera and VTR blocks but also to the RE-119 board.

・ RE-118 and RE-119 boards
The RE-118 and RE-119 boards make up a DC-DC converter. The UNREG +12 V supplied from the CNB-1 board (2/2) is converted to the various output DC voltages which are sent to the camera and VTR.
The converter system uses an highly efficient PWM switching regulator system.
The PWM switching regulator is equipped with a short-circuit protection system which turns off all power outputs when any of the output power is shorted to GND. The PWM switching regulator is also equipped with the cut-off circuit which shuts down the output power when the input voltage decreases below the guaranteed operating voltage.

Block Diagram

MDR-1

DRUM ASSY

REC A
REC B
REC C
REC D
PB C
PB D
PB A
PB B

DRUM DRIVE IC

M DRUM MOTOR

BATTERY PACK
BATT (+)
BATT (-)
BATT REM
LIGHT CONT

BATT IN

DC IN

BATT OUT
UNSW +12V

POWER

POWER SW

ON
OFF

PSW-33

CNB-1

CT-185

UNREG +12V TO CAMERA
GND TO CAMERA

DC OUT 12V

REMOTE (2/2)

UNREG +12V

RE-118

RE-119

PWM POWER CONTROLLERS

REF VOLT

SWITCHING CONVERTERS

SHORT CIRCUIT PROTECTOR

+9.3V
+7V
+3V
+2.5V
+5V
+5V-2
-5V
+48V
+15V
-11V

DC-DC CONVERTERS

DRUM FG
DRUM CURRENT
DRUM DRIVE

MPU2

DRUM SERVO

S/T REEL FG

FUNC CAM

MPU1

CAPSTAN SERVO AND MODE CONTROL

TAPE END SENSOR
TAPE TOP SENSOR
FULL TOP SENSOR
DEW SENSOR

MOTOR DRIVER

MOTOR DRIVER

M LOADING MOTOR

M CAPSTAN MOTOR

REC CTL
PB CTL

CTL R/P AMP

ERASE OSC

CTL HEAD

FULL ERASE HEAD

MDC-5

FOR TEST

FOR TEST

TC R/P AMP

PB AMP

TC HEAD

CUE HEAD (FOR ADJUSTMENT)

HN-224

OVERALL

Section 5
Periodic Maintenance and Inspection

5-1. Cleaning

To make the most of the functions, deliver the full performances of this unit and to lengthen the life of the unit and tape, clean the parts often.

5-1-1. General Information for Cleaning

1. Index

This section explains the cleaning of parts as shown in the figure below.
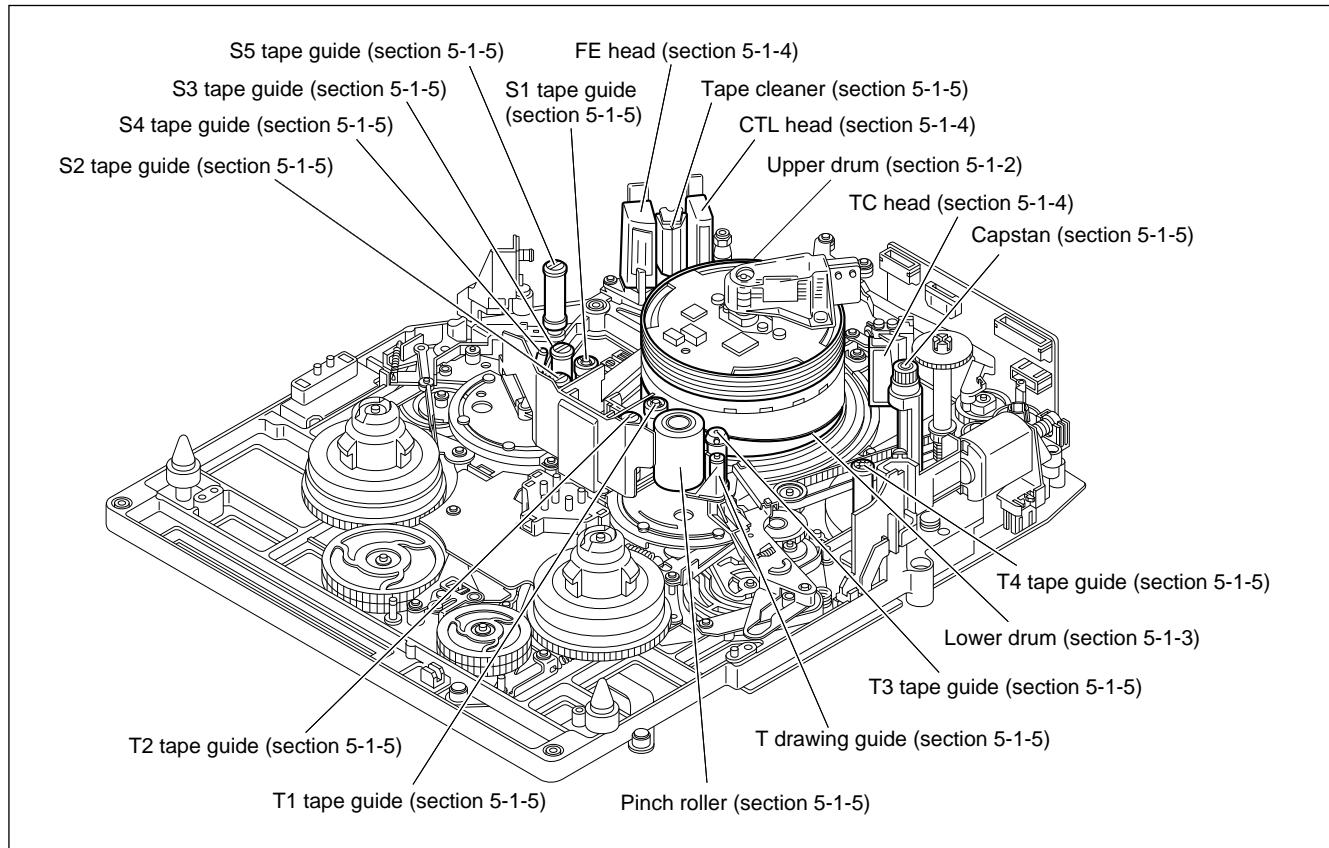
2. Notes on Cleaning

WARNING

Do not touch the rotating drum.

If you touch the drum with hand or screwdriver, it is danger to get hurt by the rapidly spinnig drum.

> ・Make sure that the rotating drum completely stops before cleaning or replacement of parts.
> ・Do not touch the rotating drum during adjusting.

・Be sure to turn the power off before cleaning.

・The blocks in the mechanical deck consist of the precision parts, and are aligned precisely. Be careful not to damage the parts, and not to apply an excessive force during cleaning.

・Do not touch the greased portions during cleaning. If grease attaches to a cleaning cloth, replace the cleaning cloth with a new one. A grease-smeared cleaning cloth may make portions where it should not be, smeary.

・Do not insert a cassette tape before cleaning fluid completely evaporates.

3. Preparations

(1) Turn the power off.

(2) Remove the front lid and the outside panel. (Refer to section 1-6.)

5-1-2. Cleaning of Tape Running Surface of Upper Drum and Video Heads

Note
The upper drum and video heads are the parts that can damage easily. Take a great care not to damage the upper drum and rotary heads during cleaning.

Tools Required
・ Cleaning cloth : 3-184-527-01
・ Cleaning fluid : 9-919-573-01

Note

Never use a cotton swab.

Procedures
1. Press the cleaning cloth moistened with cleaning fluid slightly against the position of the rotary heads installation height. Keep the cleaning cloth from contact with the rotary heads this time.

   Note

   Never press the cleaning cloth with wrinkle to the video head during cleaning.

2. Rotate the upper drum slowly in the counterclockwise direction by hand and clean it.

   Note

   Be sure to rotate the upper drum counterclockwise. (Do not clean the video heads in the vertical direction. This may damage them.)

3. After cleaning, wipe the rotary heads using a dry cleaning cloth.

Cleaning cloth

Tape running surface of the upper drum
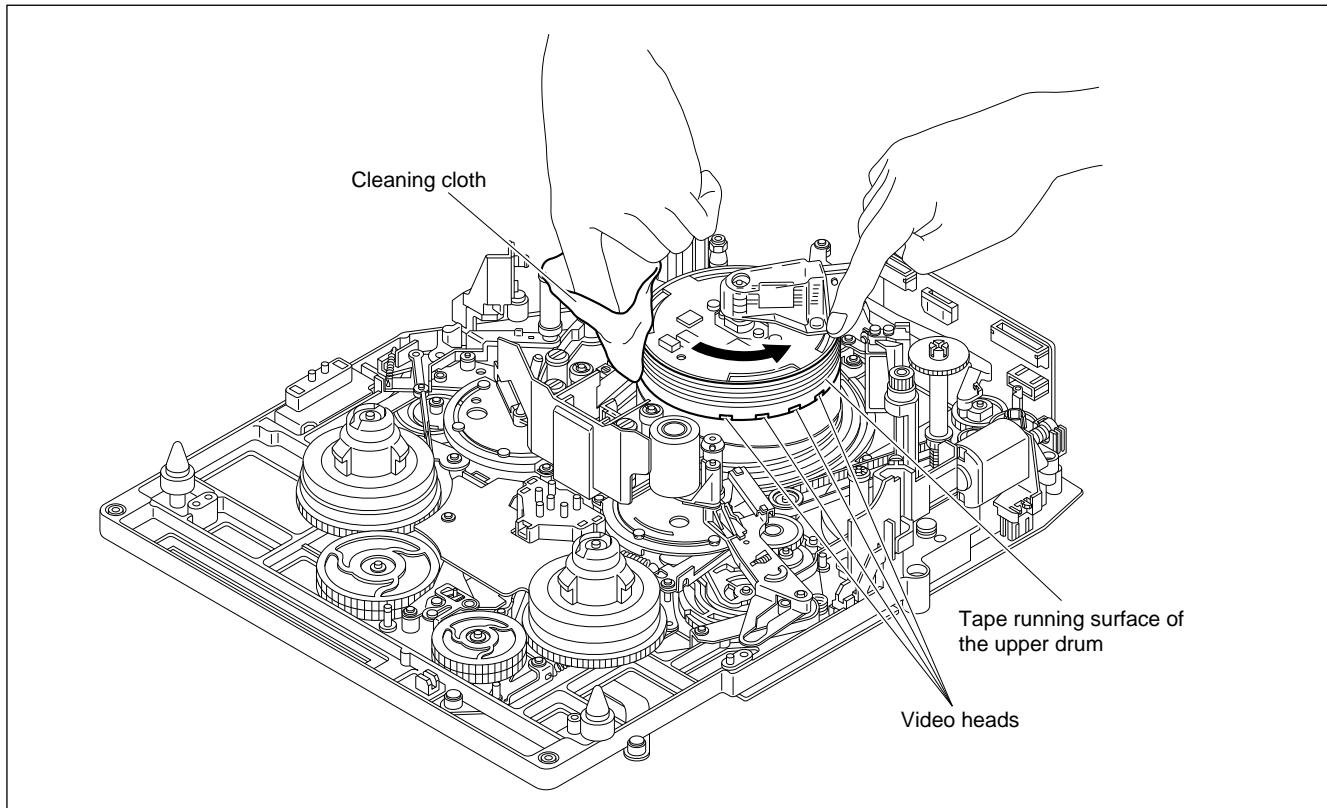
Video heads

5-1-3. Cleaning of Tape Running Surface of Lower Drum and Lead Surface

Notes

Take care not to damage the lower drum (specially lead surface) during cleaning. Take care to clean the edge portion above the lower drum because it is near the video heads.

Tools Required

- Cleaning cloth : 3-184-527-01
- Cleaning fluid : 9-919-573-01
- Skewer or an equivalent (Do not use a metallic skewer.)

Procedures

1. Put a skewer (or an equivalent) along the drum lead surface and remove magnetic powder as shown in the figure.

    Notes

    (a) Do not use a metallic skewer instead of a skewer. This may damage the tape running surface.
    (b) If the magnetic powder attached to the drum lead surface, tracking may badly influence. Remove the magnetic powder completely.

2. Clean the tape running surface of the lower drum and lead surface (shaded portion) using a cleaning cloth moistened with cleaning fluid as shown in the figure.

3. After cleaning, be sure to wipe the tape running surface of the lower drum and lead surface using a dry cleaning cloth.

Skewer   Cleaning cloth

Lead surface   Lead surface   Tape running surface of the lower drum
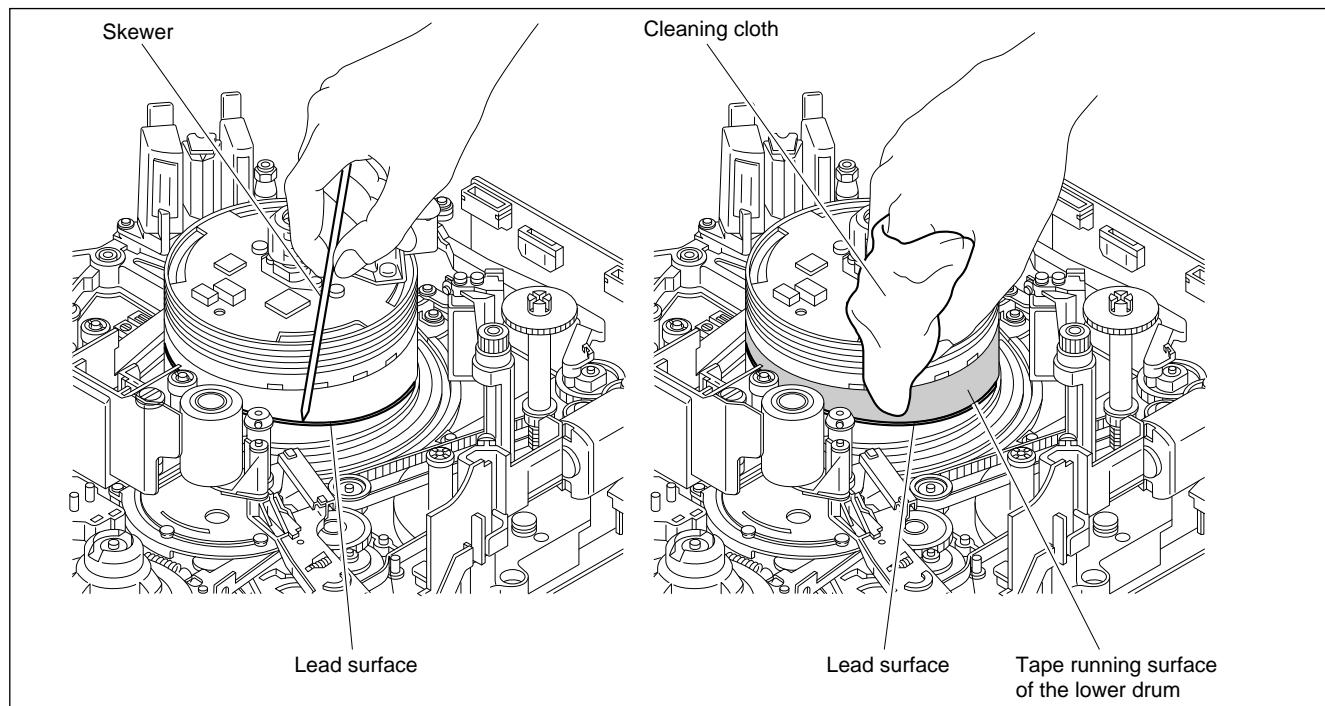
5-1-4. Stationary Heads Cleaning

Note

Take care not to damage the surfaces of the stationary heads during cleaning.

Tools Required
・ Cleaning cloth : 3-184-527-01
・ Cleaning fluid : 9-919-573-01

Procedures

1. Clean the tape running surfaces of the FE, CTL and TC heads in the vertical direction using a cleaning cloth moistened with cleaning fluid.

   ⎿ **Note** ⏌

   If the magnetic powder attached to the head gap portions of the FE, CTL and TC heads, an error may occur during recording or playback. Remove the magnetic powder completely.

2. After cleaning, be sure to wipe the tape running surfaces of the FE, CTL and TC heads using a dry cleaning cloth.
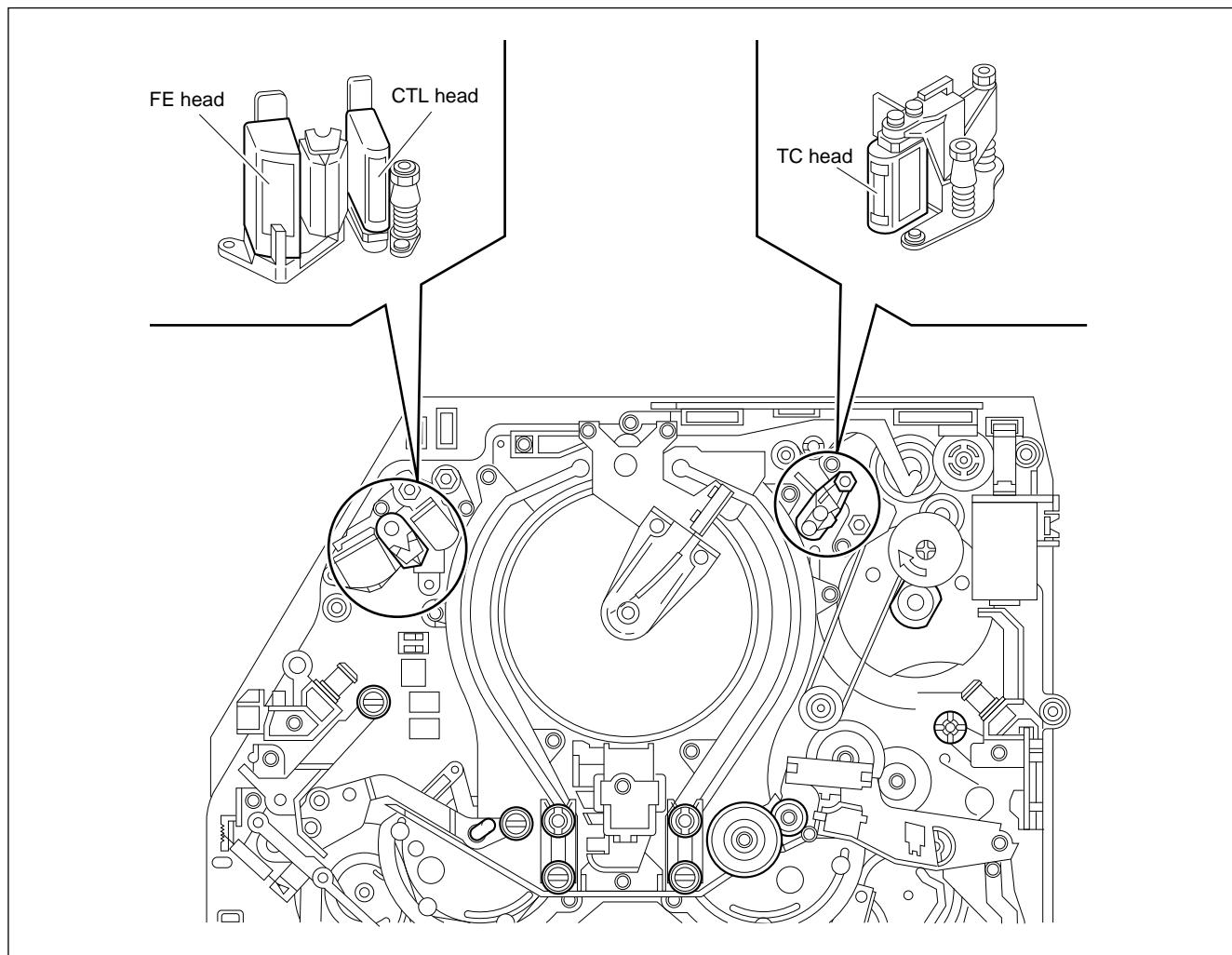
5-1-5. Cleaning of Tape Running System and Tape Cleaner

[**CAUTION**]

Tape cleaner has a sharp edge. Never touch the edge by bare hands. Take care during cleaning.

Tools Required
· Cleaning cloth : 3-184-527-01
· Cleaning fluid : 9-919-573-01

Procedures
1. Clean the tape running surfaces (shaded portions) of the following guides using a cleaning cloth moistened with a cleaning fluid as shown in the figure.

   S1 guide, S2 guide, S3 guide, S4 guide, S5 guide, T1 guide, T2 guide, T3 guide, T4 guide, T drawer guide, capstan and pinch roller.

2. After cleaning, be sure to clean it with a dry cleaning cloth two or three times.

3. Pass a piece of paper approximately this manual's paper thin through the clearance of the tape cleaner from top to bottom four or five times.
   At this time, do not move the paper from bottom to top.

   [**CAUTION**]

   Never touch the edge portion of the tape cleaner by bare hands.
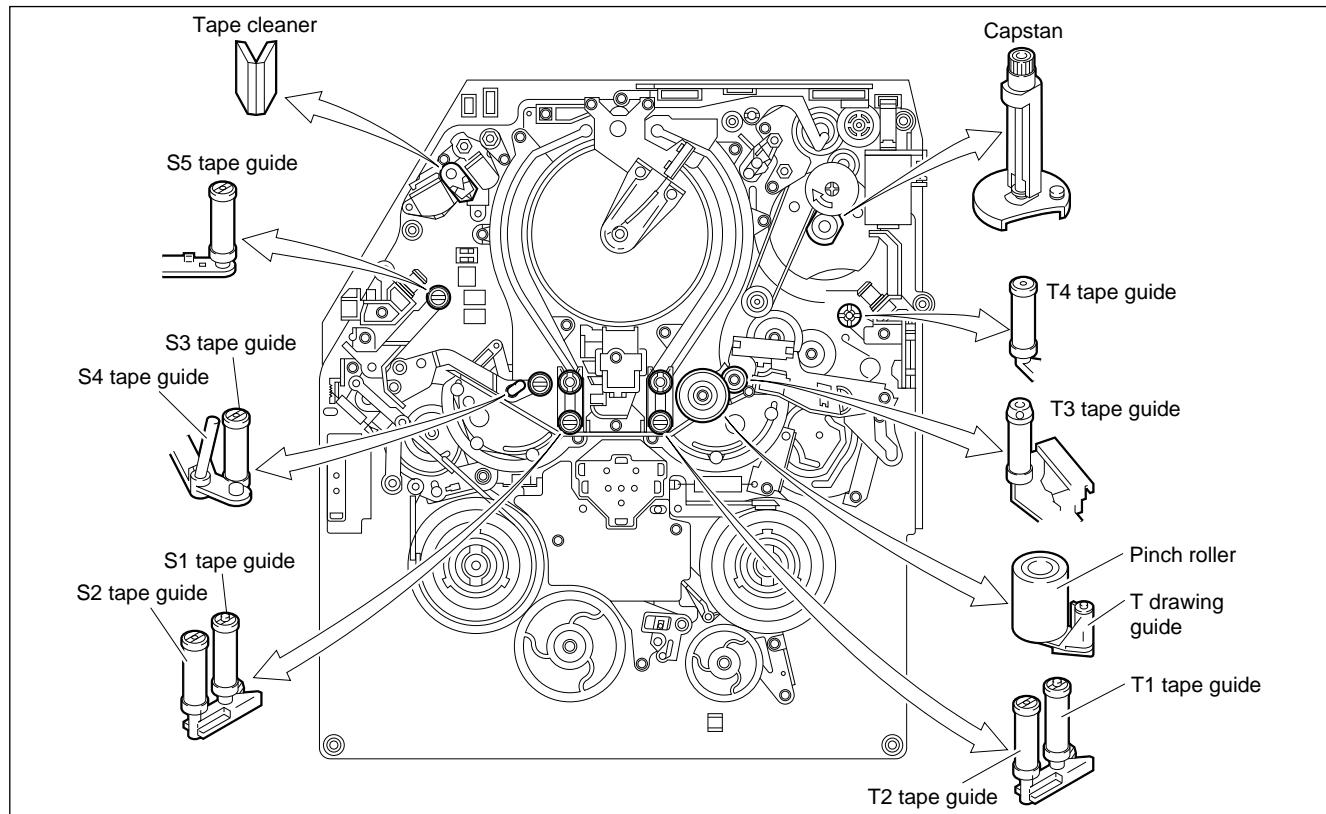
5-2. Periodic Check

To make the most of the functions, deliver the full performances of the unit, and to lengthen the life of the unit and tape, a periodic check is recommended.

5-2-1. Hours Meter

This unit can display an hours meter on the LCD display, and reset the your requested hours meter.
It is recommendable to carry out the periodic check using this hours meter as a reference.

1. Display procedures
    (1)   Press the DIAGNOSTIC switch on the side panel to enter the DIAGNOSTIC mode using the tip of a clip.
    (2)   The LCD display changes every time you press the SHIFT button on the side panel.
    (3)   Press the DIAGNOSTIC switch on the side panel to exit the DIAGNOSTIC mode.

2. Customer reset
    The hours meters of "5. DRUM RUN-2", "6. TAPE RUN-2", "7. OPERATION-2" and "8. THREADING-2" can be reset by a customer.
    (1)   While checking on the LCD display, select the hours meter to be reset by pressing the SHIFT button on the side panel.
    (2)   Press the RESET button on the side panel, and the total time of the selected hours meter will be reset.

3. Contents of display

Mode	Description
LCD display (Blinking)	
`01    XXXH`	1. Total hours of drum rotating (Display of the time by an hour)
	2. Total hours of tape running (Display of the time by an hour)
`02    XXXH`	3. Total power-on time of the unit
	(Display of the time by an hour)
`03    XXXH`	4. Total number of threading
	(Display of the threading and unthreading times)
`04    XXX`	5. Drum rotating hour (Customer-resetable)
	6. Tape running hour (Customer-resetable)
`05    XXXH`	7. Power-on time of the unit (Customer-resetable)
	8. The number of threading (Customer-resetable)
`06    XXXH`	
`07    XXXH`	
`08    XXX`	

5-2-2. Periodic Check List

Replacement time shown in the following list is not the guarantee term parts. Use this list as guidelines for the maintenance and inspection. The replacement time of the parts varies depending on the operation environment and conditions of the unit.

| Note |

The parts marked with "↓" will be replaced at the same time when the part pointed by "↓" is replaced. As for replacement procedures for the parts shown in the table, refer to the maintenance manual Part2 Volume1, Section3.

Mode A : Drum running hour
Mode B : Tape running hour

No.	Item	Mode	Inspection hours (h)			Replacement parts	
			2000	4000	6000	Part name	Part No.
1	Upper drum	A	R	R	↓	Upper drum assy DJR-15-R	A-8311-299-
2	Slip ring	A	R	R	↓	Slip ring assy (RP)	A-8311-292-
3	Brush for slip ring	A	R	R	↓	Brush assy (RP)	A-8311-293-
4	Drum	B	–	–	R	Drum assy DJH-15A-R	A-8311-298-
5	VH cleaner	A	R	R	R	VH cleaner assy	A-8278-366-
6	Tension regulator band	B	–	R	–	Tension regulator band assy	X-3678-683-
7	Reel drive gear	B	–	R	–	Reel drive gear assy	A-8278-365-
8	Pinch roller	B	R	R	R	Pinch roller assy	X-3676-032-

The "R" mark in this table indicates the replacement timing of parts.

・ Check sometimes the deformation of the eye cap of the viewfinder, and the reduction of the emission current of the CRT. Replace them as necessary.
・ Replace the lithium battery on the TC-80 board every five years.
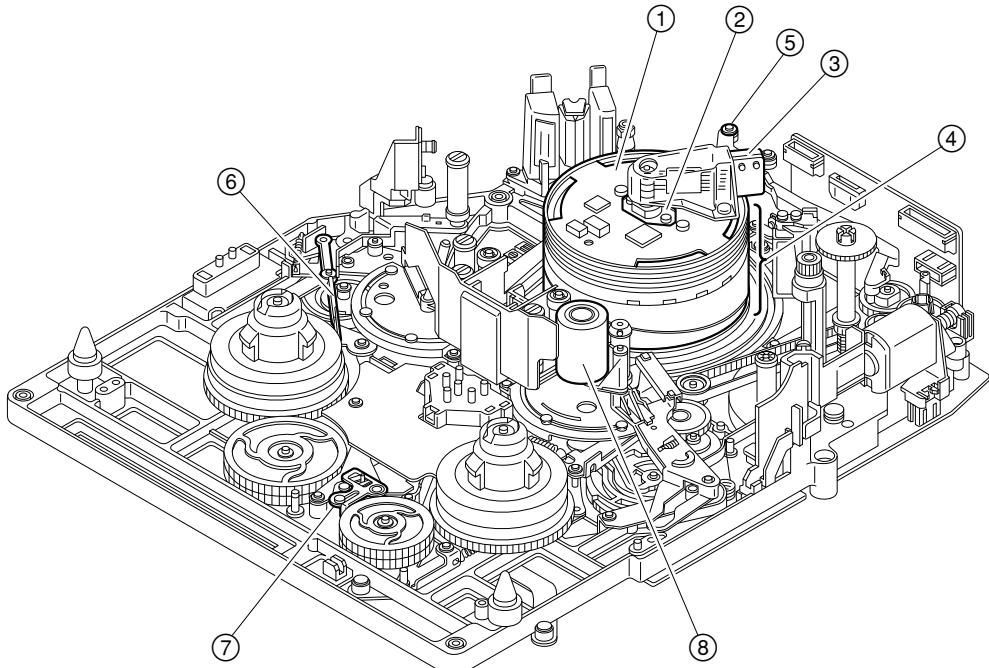
5-3.   Cares After Using at Special Environment

It is recommended to check the following items after gathering the news ant seaside of dust area.

1.   Clean off sand and other dust in the unit carefully.
2.   Clean the video heads, upper and lower drums and stationary heads.
3.   Clean the tape running surfaces (tape guides, capstan shaft and pinch roller).
4.   Clean the connectors on the connector panel.
5.   Carry out the common operation check (recording or playback) and check that the unit has not an abnormal sound or operation.

If the unit has an abnormal condition, please contact your Sony dealer.